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# Tantalum Mineralogy of Rare-Element Granitic Pegmatites from the Separation Lake Area, Northwestern Ontario

by

A.G. Tindle and F.W. Breaks

2000

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## Precambrian Geology

# Tantalum mineralogy of rare-element granitic pegmatites from the Separation Lake area, northwestern Ontario

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## ABSTRACT

The Separation Lake area is host to the most important rare-element pegmatites in Ontario. They include the Big Whopper and Big Mack petalite pegmatite systems, which potentially represent the world's second largest lithium deposit (of this type). The Separation Rapids pluton is considered to be the source of the rare-elements and the pegmatites occur in two distinct clusters adjacent to it. Beryl-type and complex-type, petalite-subtype pegmatites are the most common, and a few pegmatites have characteristics similar to the lepidolite-subtype. This study has revealed a wide range of tantalum mineral species that include; ferrocolumbite, ferrotantalite, manganocolumbite, manganotantalite, ferrotapiolite, ixiolite, strüverite, wodginite, ferrowodginite, titanowodginite, ferrotitanowodginite, microlite, bismutomicrolite, stibiomicrolite, stibiobetafite, uranmicrolite, yttropyrochlore, cassiterite and a potentially new species—a tungsteniferous variety of wodginite. Zonation patterns seen in backscattered electron images show crystallization of these minerals was not a simple process and many reactions, overgrowths and exsolution phenomena have been documented. These variations are interpreted as primary magmatic features, as secondary features related to extreme fractionation involving the late stage development of albitic units, and as evidence for interaction of hosts rocks with the pegmatite magma. In some cases, these processes elevated the tantalum content of individual minerals to extreme compositions.

Tindle, A.G. and Breaks, F.W. 2000. Precambrian geology. Tantalum mineralogy of rare-element granitic pegmatites from the Separation Lake area, northwestern Ontario; Ontario Geological Survey, Open File Report 6022, 377 p. (with 2 Appendices).

# INTRODUCTION

The purpose of this report is to document a large dataset (almost 4000 analyses) of electron microprobe analyses collected over a six-year period from tantalum-bearing minerals found in the Separation Lake area. In total, over 200 samples of granite and related aplites and pegmatites were examined. Evidence is presented that indicates the Separation Rapids pluton is the source of the tantalum (and other rare elements). Both pluton and pegmatites outcrop within the Bird River – Separation Lake metavolcanic belt, the extension of which contains the world-famous Tanco pegmatite, in Manitoba. Limited data is also presented from the Treelined Lake Complex, a S-type granite located nearby in the English River Subprovince. By far the bulk of the data are from the pegmatites themselves and these are broadly divided into beryl pegmatites and petalite pegmatites. Generally, beryl-type pegmatites are found closer to their parent granite and are less fractionated that their complex-type, petalite subtype petalite counterparts. At Separation Lake, the situation is more complex and, although petalite pegmatites do have very evolved compositions, it is a beryl-type pegmatite (at location 93-265) that is considered the most fractionated. This is thought to be due to localized concentrations of volatile species, particularly fluorine, in the pegmatite melt.

Earlier work on these minerals has been presented by Tindle, Breaks and Webb (1998): wodginite species from the eastern subgroup; Tindle and Breaks (1998): a full range of tantalum species, but from a smaller dataset; and Tindle and Breaks (in press): columbite-tantalite group species. Additional publications that contain information on tantalum mineralization at Separation Lake include Breaks (1993); Breaks and Tindle (1994); Breaks and Tindle (1996); Breaks and Tindle (1997); Breaks, Tindle and Smith (1999b); and Breaks and Tindle (submitted).

Ideal compositions of the tantalum-bearing minerals found in the Separation Lake area are listed below and should be viewed together with means, standard deviations and the locations of those samples with maximum and minimum $Ta_2O_5$ contents (Table 1).

| | |
|---|---|
| Columbite-Tantalite Group | |
| Ferrocolumbite | $FeNb_2O_6$ |
| Ferrotantalite | $(Fe>Mn)(Ta>Nb)_2O_6$ |
| Manganocolumbite | $MnNb_2O_6$ |
| Manganotantalite | $MnTa_2O_6$ |
| Ferrotapiolite | $FeTa_2O_6$ |
| Ixiolite | $(Ta,Nb,Sn,Fe,Mn)_4O_8$ |
| Strüverite | $(Ti,Ta,Fe^{3+})_3O_6$ |
| Wodginite Group | |
| Ferrowodginite | $Fe^{2+}SnTa_2O_8$ |
| Wodginite | $MnSnTa_2O_8$ |
| Ferrotitanowodginite | $Fe^{2+}TiTa_2O_8$ |
| Titanowodginite | $MnTiTa_2O_8$ |
| Un-named tungsteniferous wodginite | possibly $(LiMn_3)(Fe^{3+}{}_3Sn)(W_4Ta_4)O_{32}$ |
| Pyrochlore Group | |
| Microlite | $(Ca,Na)_2(Ta)_2O_6(O,OH,F)$ |
| Stibiomicrolite | $(Sb,Ca,Na)_2(Ta,Nb)_2O_7$ |
| Stibiobetafite | $(Sb,Ca)_2(Ti,Nb,Ta)_2(O,OH)_7$ |
| Bismutomicrolite | $(Bi,Ca)(Ta,Nb)_2O_6(OH)$ |
| Uranmicrolite | $(U,Ca,Ce)_2(Ta,Nb)_2O_6(O,OH)$ |
| Yttropyrochlore | $(Y,Na,Ca,U)_{1-2}(Nb,Ta,Ti)_2(O,OH)_7$ |
| Cassiterite | $SnO_2$ |

Figure 1 illustrates the relative importance of these minerals in terms of both their tantalum content (minerals sorted in increasing Ta$_2$O$_5$ order) and presence in a wide range of samples. Note the logarithmic scale on the x-axis. Figure 1 summarizes the entire dataset of nearly 4000 analyses and shows, that for this study, columbite-tantalite group minerals were the dominant species, with cassiterite encountered nearly as often. Ferrotapiolite, pyrochlore group minerals and wodginite group minerals were encountered less frequently, the latter group being found hardly at all in the southwestern subgroup pegmatites. Strüverite and ixiolite have limited distribution and are of little importance. Apart from cassiterite, all these minerals can contain high levels of tantalum, with ferrotapiolite, pyrochlore group minerals (e.g., microlite) and columbite-tantalite group minerals (e.g., manganotantalite) capable of exceeding 80 wt % Ta$_2$O$_5$. With cassiterite, bulk analysis may reveal much higher Ta levels than indicated here, as inclusions of other tantalum species are often found in this mineral.

Table 2 documents the mineral associations from the major groups of granites and pegmatites, highlighting the rarer occurrences. The Fe- and Mn-suites are based on columbite-tantalite compositions and are described more fully later.

The distribution of the various tantalum-bearing minerals within the Separation Rapids pegmatite group are shown in Figures 2 to 8.

The electron microprobe analyses are in Appendix B. All pertinent data are supplied in these tables, however, additional information is available only on the Miscellaneous Release-Data (i.e., the electronic version of Appendix B).

## EXPERIMENTAL METHODS AND PRESENTATION OF DATA

Mineral analyses were obtained in the Department of Earth Sciences at The Open University over a period of 6 years. Initially, a Cambridge Instruments Microscan 9 (M9) electron microprobe equipped with two wavelength dispersive spectrometers was used. Data correction was achieved with proprietary ZAF correction software. Calibration standards and X-ray lines measured were: synthetic LiF (F Kα), jadeite (Na and Al Kα), forsterite (Mg Kα), wollastonite (Si and Ca Kα), synthetic KCl (K Kα), rutile (Ti Kα), Mn metal (Mn Kα), fayalite (Fe Kα), cassiterite (Sn Lα), synthetic FeNb$_2$O$_6$ (Nb Lα), synthetic NaTaO$_3$ (Ta Mα), synthetic WO$_3$ (W Mβ), galena (Pb Mα). synthetic ThO$_2$ (Th Mα) and UO$_2$ (U Mβ). Sc (Kα), Sb (Lα) and Bi (Lα) were measured in some samples and calibrated against pure metal standards. Although the W Mβ line has a potential interference from a second-order Sn line, the interference was shown to be insignificant at concentrations of less than 12% SnO$_2$. An operating voltage of 20kV and probe current of 30nA (measured on a Faraday cage) were used. Count times varied from 20 to 50 seconds per element. In 1996, the M9 microprobe was replaced with a Cameca SX100 microprobe fitted with four wavelength spectrometers and the analytical conditions were revised to an operating voltage of 20kV and probe current of 20nA. A "PAP" correction procedure was used (Pouchou and Pichoir 1985). New standards were also obtained at this time (mainly from Astimex Ltd.) and replaced some of those previously used, for example, feldspar (Al, Si and K Kα), ScPO$_4$ (Sc Kβ), bustamite (Mn and Ca Kα), hematite (Fe Kα), YPO$_4$ (Y Lα), stibnite (Sb Lα), Bi$_2$Se$_3$ (Bi Lα), Ta metal (Ta Mα) and crocoite (Cr Kα and Pb Mα). Synthetic WO$_3$ continued to be used, but now with the W Mα line. Approximately 85% of all data presented here were obtained using the Cameca SX100 microprobe. Data obtained on the M9 microprobe were mainly from eastern subgroup pegmatites. All backscattered electron images were obtained on the SX100 microprobe.

Li, Fe$^{2+}$ and Fe$^{3+}$ contents of wodginites were estimated using the method of Ercit et al. (1992b). Further details are published in Tindle, Breaks and Webb (1998). Microsoft Excel™ spreadsheets that perform this calculation and structural formulae calculations for columbite-tantalite and pyrochlore species are available from the following web address:

http://exodus.open.ac.uk/earth/indiv_home_pages/A_Tindle/Probe/ProbeLab.html

Coloured backscattered electron images of some tantalum minerals from the Separation Rapids pegmatites are also on this site under "Mineral Chemistry" at

http://exodus.open.ac.uk/earth/indiv_home_pages/A_Tindle/AGTWebPages/AGTHome.html

## COLUMBITE-TANTALITE GROUP MINERALS

Minerals of the columbite-tantalite group are the most common Nb-Ta species in rare-element pegmatites and have the general formula of $AB_2O_6$ in which the A position is occupied mostly by $Fe^{2+}$ and $Mn^{2+}$ and the B position mostly by $Nb^{5+}$ and $Ta^{5+}$. The end-members ferrocolumbite ($FeNb_2O_6$), manganocolumbite ($MnNb_2O_6$) and manganotantalite ($MnTa_2O_6$) are all orthorhombic minerals as is ferrotantalite ($(Fe>Mn)(Ta>Nb)_2O_6$). This latter species, however, is not an end-member. The end-member composition $FeTa_2O_6$ belongs to ferrotapiolite, a tetragonal species of the tapiolite series. All these species can be represented on the columbite-tantalite quadrilateral (*see* Figures 9 to 13).

The columbite-tantalite quadrilateral is now used extensively to illustrate fractionation trends in the rare-element class of pegmatites (summary in Černý and Ercit 1985). A preliminary generalized summary (Černý 1989a, 1992) indicates that the evolution of individual types of rare-element pegmatites follow different paths when their compositions are plotted on the columbite-tantalite quadrilateral (Figure 9). This fractionation behaviour may be strongly influenced by the activity of fluorine (Černý 1992; Uher et al. 1994; Abella, Corbella and Melgarejo 1995; Spilde and Shearer 1992). Beryl-type pegmatites from Yellowknife, Northwest Territories, Canada represent one such fluorine-poor system, where the fluorine-rich minerals microlite and lepidolite are either scarce or absent and where fractionation progressed from ferrocolumbite to niobian ferrotantalite, ixiolite and ferrotapiolite (Wise, Meintzer and Černý 1986). Throughout the following discussion of the columbite-tantalite group, the abbreviations $X_{Mn} = Mn/(Mn+Fe)$ and $X_{Ta} = Ta/(Ta+Nb)$ are used.

Complex-type pegmatites, characterized by the presence of substantial quantities of lithium aluminosilicates, represent the other major group of rare-element class pegmatites. These span a wide range of compositions with the spodumene subtype (e.g., Tin Mountain pegmatite, South Dakota: Walker et al. 1986) perhaps the most common variety. Changing bulk chemistry and *P–T* conditions (increasing temperature and decreasing pressure) results in the formation of petalite, lepidolite and amblygonite subtypes—all noted for reflecting a high activity of fluorine. This seems to be a prerequisite for effective Fe-Mn fractionation to high Mn compositions (Figure 9; Černý 1989a, 1992)—a particularly pronounced feature of lepidolite subtype pegmatites (e.g., Brown Derby, Colorado: Heinrich 1967). The high fluoride salinity ± increased $\mu HF$ in lepidolite subtype pegmatites modifies the mineralogy of Nb, Ta oxides strongly in favour of microlite and also leads to the crystallization of extremely manganese-rich garnets and phosphates (Černý 1989a).

The Separation Rapids pegmatites are beryl type and complex type (petalite subtype), although a few pegmatites (such as the Swamp pegmatite and part of the Big Whopper pegmatite) have characteristics similar to complex type, lepidolite-subtype pegmatites (e.g., $X_{Mn} \approx 1$). The entire columbite-tantalite dataset from the Separation Lake area (1758 analyses) is plotted on Figure 10a and indicates a much more complex situation than that described previously by Tindle and Breaks (1998). Also shown on Figure 10a is the entire ferrotapiolite dataset.

Tindle and Breaks (1998) describe ferrocolumbite from the Separation Rapids pluton as being the most primitive in the complex (open squares on Figure 10b). The larger dataset illustrated in Figure 10b shows a broader range of predominantly ferrocolumbite compositions and includes samples from near the southern margin (filled diamonds) which has been shown to be the most evolved part of the intrusion (Breaks and Tindle 1994). Also in close proximity to the southern margin of the pluton, at locality 93-260, Li mica-cleavelandite pods (3 samples: open triangles, diamonds and circles on Figure 10b) containing alluaudite $NaCaFe_{2+}(Mn,Fe,Mg)_2(PO4)_3$ are found in a pegmatitic mass within the pluton. The data crossing the ferrotantalite-manganotantalite boundary (open triangles) are from inclusions in large cassiterite grains (2 to 6 mm in length), whereas the other two samples are from discrete manganocolumbite and manganotantalite grains.

Figure 10b also shows data from the Treelined Lake granitic complex, which, if Breaks and Tindle's (1997) contention that this was the source of the Separation Rapids pluton is correct, might be expected to be of very primitive ferrocolumbite composition. The data are, however, from a miarolitic cavity within an *in situ* cassiterite-topaz, sodic pegmatite segregation and is mainly of manganocolumbite composition. No columbite-tantalite was found elsewhere in the Treelined Lake granite itself.

The above primitive columbite-tantalite compositions suggest that the Separation Rapids pluton may indeed have been the source of the pegmatites, but that it also fractionated internally and, in a similar way to the miarolitic cavities from the Treelined Lake granitic complex, the Li mica-cleavelandite pods are interpreted as fluid-enriched “pockets” within the magma, the exact nature of which are not fully understood.

The beryl pegmatites (Figure 11) are the next group in the peraluminous fractionation sequence of Breaks and Tindle (1997). It has previously been established that they divide into two main groups termed the Fe-suite and Mn-suite by Tindle and Breaks (1998). In Figures 11a and 11b, the eastern and southwestern (SW) pegmatite subgroups are shown with Fe-suite samples on the left of the diagrams and Mn-suite samples on the right. For the Fe-suite eastern subgroup pegmatites there is a gradual increase in $X_{Mn}$ with increasing $X_{Ta}$, but this is less well defined in the SW subgroup pegmatites. A subset of the Fe-suite SW subgroup samples define a cluster on Figure 11b (open triangles) with low $X_{Mn}$ (0.05 to 0.10). These samples (96-9 and 96-81) are spatially associated with a Cs anomaly in adjacent host rocks (Figure 2) and co-exist with ferrotapiolite.

Mn-suite beryl pegmatites have a more restricted occurrence than their Fe-suite counterparts, but potentially are of more interest, as they have been shown to concentrate Ta to a greater extent ($Ta_2O_5$ reaches 82.99 wt % in manganotantalite from sample 93-265AM).

In the eastern subgroup (Figure 11a), three Mn-suite pegmatites or aplites have been found: an internal (to the Separation Rapids pluton) garnet-muscovite-quartz-albite aplite (location 93-263); an external pegmatite, proximal to the pluton, at location 93-265; and a more distal topaz-garnet-muscovite aplite at location 94-304. Metasomatic selvedges, which developed in mafic metavolcanic host-rocks around the aplites (in particular at location 94-304), contain excessively high fluorine levels (5 to 8.5 wt % F in bulk samples) and indicate crystallization of the aplites was from a fluorine-rich source. Of these three samples, it is only the pegmatite at location 93-265 that is a sizeable intrusion, and of further interest because of its zonation and development of Li mica-cleavelandite pods (host to manganotantalite with the extreme Ta content described above).

In the SW subgroup, Mn-suite pegmatites are also uncommon. Two occurrences are of minor importance: 97-10A, a 1 m thick garnet-fluorapatite-muscovite-chrysoberyl aplite, and 96-86A from a Li mica-fluorapatite-cleavelandite pod in a 250 by 300 m small stock of pegmatitic leucogranite and potassic pegmatite. A third occurrence of Mn-suite pegmatite at the Wolf zone (discovered by A. Pryslak and S. Sears of Champion Bear Resources in the summer of 1999) appears to be more substantial.

In comparison with beryl-type pegmatites from elsewhere in the world (Figure 9), it is the columbite-tantalite compositions of the Fe-suite beryl samples that appear to be most typical. Mn-suite beryl pegmatites from Separation Rapids appear to be unusual, however, the presence of ferrocolumbite and ferrotantalite inclusions in topaz from sample 94-304, a Mn-suite aplite, provides a crucial link between Fe-suite and Mn-suite pegmatites (two solid circles on left side of Figure 11a). It is likely that the inclusions crystallized early, possibly before intrusion of the pegmatite magma, and were protected from further change during late-stage melt evolution by being encased in topaz. Other columbite-tantalite grains in this sample appear to have crystallized directly from the increasingly fluorine-rich melt and have manganocolumbite compositions (right side of Figure 11a).

The eastern subgroup petalite pegmatites were shown to be the most evolved members of the peraluminous fractionation sequence as defined by Breaks and Tindle (1997) on the basis of potassium-feldspar data. Columbite-tantalite data from the eastern subgroup Fe-suite and Mn-suite petalite pegmatites (Tindle and Breaks 1998) have been supplemented with new data and three distinct groupings have now emerged (Figures 12a and 12b). The first group, represented by Pegmatites 9 and 10, have $X_{Mn}$ values around 0.15, similar to the Separation Rapids pluton and consistent with derivation from that pluton. The second group, comprising Lou's, James' and pegmatites 1, 5, 7, 8 and 11, are offset to higher $X_{Mn}$ (0.30) and presumably were released from a similar source to that which produced the evolved pluton composition (as represented by sample 94-29). The third group of data (Figure 12b) is from Marko's pegmatite, the largest petalite pegmatite of the eastern subgroup, and the only one belonging to the Mn-suite. Marko's pegmatite is unusual in having two well-defined trends in which variation in $X_{Ta}$ is initially suppressed and varies from $X_{Mn} = 0.40$, $X_{Ta} = 0.15$ to $X_{Mn} = 0.8$, $X_{Ta} = 0.25$ and from which a second trend continues "almost vertically" (relatively static $X_{Mn}$) upward to $X_{Ta} = 0.70$. An initial melt of relatively primitive composition similar to that from the second group of Fe-suite petalite pegmatites is indicated for Marko's pegmatite on the evidence of the columbite-tantalite data. The flat trend (constant $X_{Ta}$) is defined by samples from the layered pegmatite-aplite unit of Marko's pegmatite (i.e., one of the outer, earlier crystallizing units of the pegmatite) and could reflect the fact that garnet (the principal iron-bearing and manganese-bearing mineral in these rocks) crystallized contemporaneously with the ferrocolumbite-manganocolumbite. When garnet crystallization terminated, there was a local decoupling of Fe and Mn from Nb and Ta, and fractionation continued to produce the vertical (constant $X_{Mn}$) manganotantalite trend—a trend defined by samples from the inner, petalite-rich core zone of the pegmatite. Marko's pegmatite follows a trend of enrichment similar to other pollucite-bearing pegmatites worldwide (Černý 1989a), and clearly indicates Mn-suite pegmatites are the most likely candidates to be associated with anomalously high concentrations of cesium (and rubidium).

A factor that may have played a role in increasing the Fe content of the early crystallized columbite-tantalite at Marko's pegmatite is interaction with metavolcanic and banded iron formation host rocks. Tindle, Breaks and Webb (1998) concluded that the exotic mineralogy (including titanowodginite, ferrotitanowodginite and stibiobetafite) of the wall zone of Marko's pegmatite could not be explained by normal crystal fractionation processes and suggested there had been influx of Fe and Ti from the host rocks into the pegmatite melt. This is the likely cause for some of the scatter in the ferrocolumbite data and iron-rich manganotantalite compositions in the more evolved samples from Marko's pegmatite (Figure 12b). In comparison with petalite pegmatites from other locations worldwide, it is Marko's pegmatite that appears to be most typical (Figure 9).

Data from the SW subgroup petalite pegmatites are more difficult to interpret as they have a wide compositional range and little obvious systematic behaviour (Figures 13a and 13b). This is somewhat unfortunate as the two giant Separation Rapids pegmatites, the Big Mack and Big Whopper pegmatites, both belong to this group. Of the two, the Big Mack pegmatite (and close neighbour, the Zone 11 pegmatites) appear to have crystallized from a more primitive, relatively fluorine-poor, parental composition and like most Separation Rapids pegmatites, fractionation within individual samples produced limited $X_{Mn}$, but broad $X_{Ta}$ variations. There does, however, appear to be a continuum from Big Mack compositions into those from the Big Whopper pegmatite and it is not inconceivable that the Big Mack is a precursor to the Big Whopper pegmatite. Columbite-tantalite variation in the Big Whopper pegmatite is discussed further in Tindle and Breaks (in press). In summary, the most primitive compositions are from a ferrocolumbite-eucryptite ($LiAlSiO_4$)-bearing sodic pegmatite sample (97-185A) collected near the northern contact of the Big Whopper pegmatite and from a borehole sample (DC97-8-57) belonging to Unit 4 of Avalon Ventures Ltd ($X_{Mn}$ = 0.25-0.35; $X_{Ta}$ = 0.05-0.10). The bulk of the Big Whopper pegmatite progressively evolved from manganese-rich ferrocolumbite ($X_{Mn}$ = 0.40; $X_{Ta}$ = 0.15) to manganocolumbite ($X_{Mn}$ = 0.90; $X_{Ta}$ = 0.50) compositions and variation continued to manganotantalite compositions ($X_{Mn}$ = 0.90; $X_{Ta}$ = 0.75). This was followed with the intrusion of a lepidolite-quartz-albite-topaz unit (Unit 6D of Avalon Ventures Ltd.) which has manganocolumbite-manganotantalite compositions with extreme Mn-enrichment ($X_{Mn}$ = 0.97; $X_{Ta}$ = 0.40-0.75) characteristic of complex-type, lepidolite-subtype pegmatites (Černý 1991, 1992). Sample 97-BW5 (solid squares on Figure 12a) was collected from a loose block over the Big Whopper and its anomalous position on Figure 12a raises doubts to its parentage. Interestingly, at location EFR-6059, halfway between the Big Mack and Big Whopper pegmatites and on Emerald Fields Resource Corporation property, an outcrop of petalite pegmatite containing manganotantalite with relatively high $Ta_2O_5$ contents (60 to 69 wt %) has been found. With further sampling, this area should help to establish more fully any link between the two giant pegmatites.

The remaining SW subgroup petalite pegmatites form a disparate group that cross the Fe-suite and Mn-suite boundary (Figure 13b). Perhaps most important of these is the Glitter pegmatite that currently defines the western extension of the Big Mack system and has similar ferrocolumbite-ferrotantalite compositions to the Big Mack and Zone 11 pegmatites. It occurs 5 km away from the Separation Rapids pluton and 14 km away from the most distal eastern petalite pegmatites. The Glitter pegmatite is highly deformed, exhibiting isoclinal folding similar in style to that of the Big Mack and Big Whopper pegmatites (Breaks and Tindle 1997; Breaks, Tindle and Smith 1999b).

High Ta concentrations in columbite-tantalite are further reported from the Great White North and Swamp pegmatites, both of which belong to the Big Whopper system. The latter pegmatite has chemical affinities with the lepidolite unit of the Big Whopper and its manganocolumbite-manganotantalite has the highest mean $Ta_2O_5$ content of all pegmatites from the Separation Lake area (mean 60.19 wt %).

A summary of mean $Ta_2O_5$ contents of columbite-tantalite group minerals from all samples analyzed in this work is presented in Table 3. This summary (and others) should be examined with a little caution as the data coverage is not systematic or directly comparable from one pegmatite to another. Marko's pegmatite, for instance, has been examined in more detail than any other pegmatite for reasons other than its columbite-tantalite content (i.e., because it is the only Separation Rapids pegmatite to contain the Cs mineral pollucite, and because it hosts extremely rare Ta species—ferrotitanowodginite, titanowodginite, tungsteniferous wodginite and stibiobetafite). Another important consideration is that, whereas most columbite-tantalite occurs as discrete grains, it can also occur as inclusions in other minerals. In many cases, cassiterite is the host mineral, where benefication may be problematical (e.g. some of the data from 93-260C, 94-15A, 94-304C, 94-Peg7B, 96-13B, 96-29D, 96-53A, 96-AT5, 97-1, 97-BW5, 97-BW7B, 97-P10-3, 97-WP3, 99-ATZ11, 99-GZ4 and 99-GZ5).

Another variable to consider is that columbite-tantalite invariably forms zoned crystals (Photos 1, 2 and 3) and this can have a marked effect on Ta content. A range of 20.7 to 40.7 wt % $Ta_2O_5$ is recorded in a single crystal of ferrocolumbite from a Zone 11, SW subgroup, Fe-suite petalite pegmatite (99-ATZ11;

Photo 1d). An even greater range of 23.7 to 69.0 wt % $Ta_2O_5$ is recorded in SW subgroup, Mn-suite petalite pegmatite (EFR-6059). The origins of zonation are complex and are covered in considerable detail in Tindle and Breaks (in press). In summary, there are two basic types of zonation:

1. Oscillatory zonation is caused by fluctuating magmatic conditions in which Ta (and other elements) become more or less available for precipitation on a cyclical basis and this leads to the formation of crystals with a striped pattern when observed with backscattered electrons (BSE). Differences in mean atomic number are highlighted by varying grey levels in a BSE image and Photo 1 illustrates a few examples. For columbite-tantalite minerals, bright regions correspond to relatively high Ta contents. This zonation is considered to be a primary magmatic phenomenon. In many cases, oscillatory zonation produces crystals with a niobium-rich core and a tantalum-rich rim (e.g., Photos 1a, 1e and 1f), but reverse zonation can also occur (e.g., Photo 1b).

2. Patchy zonation produces much more irregular zonation patterns than oscillatory zonation and Photo 2 shows a few examples. Photo 2a is particularly revealing, as it shows an unzoned tantalum-rich manganotantalite with a patchy zoned niobium-rich ferrocolumbite portion at one end. This zonation is interpreted as a late-stage (but probably still dominantly magmatic) alteration phenomena and is very common throughout the Separation Rapids pegmatites. Patchy zonation may completely overprint an earlier zonation pattern, particularly in those samples from late-stage Li mica-cleavelandite pods (e.g., 96-86A and 94-44Mu5(2); Photos 2b and 2d, respectively). There is a correlation of patchy zonation with the passage of magmatic fluids and many affected grains are from albitized units where corrosive sodium-rich fluids have concentrated.

Photo 3 illustrates further complexities of columbite-tantalite crystallization with examples of multiple phases of crystallization (Photos 3a, 3b and 3c); patchy zonation, where $X_{Mn}$ rather than $X_{Ta}$ is the main variable; and overgrowths and reactions with microlite (Photos 3e and 3f).

## Ferrotapiolite

Ferrotapiolite forms in rare-element pegmatites exhibiting moderate to high degrees of fractionation characterized by low levels of F (Wise and Černý 1996). Only rarely is ferrotapiolite the sole representative of Ta mineralization in a pegmatite (von Knorring and Fadipe 1981). The existence of a compositional gap between ferrotapiolite and ferrotantalite (Figures 11, 12 and 13) is a common feature and is controlled by temperature, $f(O_2)$, structural state of the co-existing phases, impurities and probably also by pressure (Černý, Ercit and Wise 1992).

Ferrotapiolite, $Fe(Ta,Nb)_2O_6$, is an uncommon oxide in the Separation Rapids pegmatites, but is of importance because of its consistently high Ta content (70 to 80 wt % $Ta_2O_5$), unlike any of the other Ta species described (Figure 1). Significant occurrences of ferrotapiolite are in SW subgroup pegmatites (96-9, Photo 4a; 96-81, Photo 4d; and 98-83F) and in the SW margin of the Separation Rapids pluton (96-72A; Photo 4c). Samples 96-9 and 96-81 are from beryl pegmatites that were intruded close to one another and around which metasomatic alteration of metavolcanic host rocks resulted in elevated Li contents up to 245 ppm compared to "background" levels of 16 ppm. Cs levels are also anomalously high in the metasomatic selvedges, reaching 14 000 ppm in this small area of 200 $m^2$ (Breaks and Tindle 1997). In the two beryl pegmatites, the ferrotapiolite co-exists with ferrotantalite that has a distinctive composition characterized by low $X_{Mn}$ (Figure 11b) consistent with derivation from a low F melt. Unusually, in the pluton, ferrotapiolite occurs with ferrowodginite. The most important occurrence of ferrotapiolite is found in the Big Mack pegmatite (98-83F), where it occurs with no other Ta species. Surprisingly, this is the only sample, to date, from this pegmatite to host ferrotapiolite, and other samples nearby contain (mainly) ferrocolumbite instead.

Minor occurrences of ferrotapiolite are predominantly from isolated inclusions in cassiterite (Table 4), where single 5 to 30 µm grains have been detected (e.g., in SW beryl pegmatite 96-11A and eastern petalite pegmatite 94-80P). Two examples, from a sodic SW beryl pegmatite (96-53) and from the SW petalite Glitter pegmatite are illustrated in Photos 4b and 10f. A further example from an Fe-suite eastern subgroup petalite pegmatite (Pegmatite 10, 97-P10-4) is illustrated in Photo 14, where ferrotapiolite forms trains of rounded blobs that are interpreted as exsolution products in the cassiterite.

Although ferrotapiolite is predominantly absent or insignificant in the eastern subgroup pegmatites, a notable ferrotapiolite-like phase occurs in the eastern end of the wall zone of Marko's pegmatite (94-44Z, Photo 5f). Its unusual composition is attributable to partial replacement of ferrotapiolite along cleavage planes by microlite (data is tabulated under pyrochlore group minerals). Only Pough (1945) and Eid and von Knorring (1976) appear to have reported this process previously. As with replacement of wodginite and manganocolumbite by microlite, replacement of ferrotapiolite by microlite requires interaction with a (Ca, Na, F)-rich fluid.

In summary, the scarcity and apparently random distribution of ferrotapiolite make it an unlikely ore mineral unless it can be found in greater quantities elsewhere in the region. The nature of this distribution is not consistent with it being a normal fractionating phase and influx of Fe from adjacent metavolcanic host rocks into the pegmatite melt was probably required for its formation. Its presence, however, can be indicative of pegmatite crystallization from very evolved magmas enriched in Li and Cs (but not F) and the pegmatites from which samples 96-9 and 96-81 were collected probably originated from the most volatile-poor parental magmas of all the Separation Rapids pegmatites.

## Ixiolite

Ixiolite is a complex Ta oxide with a formula $(Ta,Nb,Sn,Fe,Mn,Ti)_4O_8$ and an orthorhombic unit cell corresponding to that of disordered columbite-tantalite. The bulk chemistry of ixiolite is similar to that of ferrotantalite, but differs in converting to a monoclinic structure (akin to wodginite) after heat treating at 1000°C (Mulja et al. 1996). As well as the tin- and tantalum-rich "type" ixiolite, other ixiolite varieties contain substantial $Sc^{3+}$, $Fe^{3+}$, $Ti^{4+}$, $W^{6+}$, U and $Nb^{5+}$. Such a range of cations with a broad range of ionic radius and valence requires that the ixiolite structure be extensively flexible. There is a need to rationalize the ixiolite group and to develop a crystallochemical classification and nomenclature as, in many cases, members have lower than orthorhombic symmetry (Černý and Ercit 1989) and can be confused with columbite-tantalite. Without structural information, it is often difficult to make a positive identification of ixiolite. If only chemical data are available (as here), then columbite-tantalite and ixiolite can best be represented on a diagram such as Figure 14. Columbite-tantalite, with ideal $AB_2O_6$ stoichiometry falls along a tie line between Nb and Ta = 2 atoms per formula unit (apfu), and ixiolite, with ideal $ABO_4$ stoichiometry, along a tie line between Nb and Ta = 1.5 (apfu). For the Separation Rapids pegmatites, a dividing line between the two has been defined at Nb and Ta = 1.8 (apfu), a similar position as that defined by Neiva (1996) for columbite-tantalite, ixiolite and wodginite from Portuguese tin and tungsten deposits.

The relative importance of ixiolite can be gauged by considering the combined columbite-tantalite and ixiolite dataset of 1779 analyses. Only 21 analyses, or 1.1% of the data are defined as ixiolite and it occurrence is restricted to six Separation Rapids pegmatites (Pegmatites 7, 9, 11, Marko's, Lou's and the Big Whopper, which are all petalite pegmatites) and one unusual graphite-rich pegmatite from the northern fringes of the Treelined Lake complex (96-2). Of these, only the data from the Big Whopper pegmatite and one analysis from Pegmatite 9 conform to ideal stoichiometry (Figure 14).

Two examples of ixiolite are illustrated in Photo 5: a scandium-, titanium-rich variety from Lou's pegmatite included within a large grain of cassiterite (Photo 5a) and a tungsten-, tin-rich variety from Pegmatite 9 that occurs as a discontinuous rim on an earlier formed crystal of ferrocolumbite-ferrotantalite (Photo 5b). Other examples are either found as inclusions in cassiterite or niobian rutile, or in close association with other tantalum species.

## Strüverite

Strüverite $(Ti,Ta,Fe^{3+})_3O_6$ and ilmenorutile (its Nb analog) are, respectively, the tantalum and niobium varieties of rutile $TiO_2$. Compositionally, they are interpreted as solid solutions of rutile and "mono-tapiolite", $(Fe,Mn)(Nb,Ta)_2O_6$ and, invariably, they show a slight to considerable excess of (Fe+Mn) over (Nb+Ta) (as in Figure 15). Cation totals normalized to 4 oxygens frequently exceed the ideal value of 2.00, when all Fe is calculated as $Fe^{2+}$, suggesting that some (if not all) Fe is present as $Fe^{3+}$ (Černý and Ercit 1989).

In the Separation Lake region, strüverite has only been found in nine samples: from four Separation Rapids pegmatites (beryl pegmatite 96-9, and three petalite pegmatites: Pegmatite 11, Marko's, Big Mack) and from a graphite-rich pegmatite from the northern fringes of the Treelined Lake complex (96-2). In this latter occurrence and for some data from Marko's and the Big Mack pegmatites, the Nb/Ta ratio more correctly defines the analyses as being ilmenorutile. Excluding these analyses from the strüverite average of Table 1 gives a revised average of 44.18 wt % $Ta_2O_5$ and a standard deviation of 11.36.

In the wall zone of Marko's pegmatite, strüverite occurs as an 0.3 mm anhedral inclusion in coarse-grained albite, where it appears to be replacing manganotantalite, and, in a second occurrence, a titanowodginite inclusion in a large cassiterite has been partially replaced by patchy zoned strüverite. The strüverite has continued growing out from the margin of the cassiterite and has developed both euhedral form and well-defined oscillatory zonation (Photo 5c).

In the Big Mack pegmatite, at location 98-83C, strüverite has been found in a border zone garnet-muscovite-quartz-albite unit. The presence of cordierite, holmquistite and associated selvage material within the pegmatite indicate local conditions where Ti and Fe were likely introduced from the host rocks. In sample 98-83Ciii, a chromian variety of strüverite has been found that could not possibly have crystallized directly from the pegmatite melt. Localized introduction of Cr into the pegmatite from adjacent mafic intrusive rocks is the most plausible explanation.

A number of strüverite grains from the Big Mack pegmatite have an unusual skeletal form (Photo 5d) and/or show marginal replacement by an impure ferrowodginite approaching ixiolite in composition (Photo 5e). This relationship is unique to the Big Mack pegmatite.

## WODGINITE GROUP MINERALS

Wodginite was first described by Nickel, Rowland and McAdam (1963) as a monoclinic mineral with a unit cell content of $(Ta,Mn,Sn,Nb,Fe,Ti)_{16}O_{32}$. Progressive improvement of the structure refinement (summaries in Ercit, Hawthorne and Černý 1992a; Ercit et al. 1992b) confirms a general formula $A_4C_4B_8O_{32}$, where A = Mn, $Fe^{2+}$; C = Sn, Ti, $Fe^{3+}$; Ta and B = Ta, Nb. Based on the chemistry of A- and B-cation sites, Ercit, Černý and Hawthorne (1992c) were able to devise a classification scheme in which wodginite ($MnSnTa_2O_8$), ferrowodginite ($Fe^{2+}SnTa_2O_8$), titanowodginite ($MnTiTa_2O_8$) and lithiowodginite ($LiTaTa_2O_8$) were all defined. Both Ercit (1992c) and Tindle, Breaks and Webb (1998) presented data from a further species, "ferrotitanowodginite" ($Fe^{2+}TiTa_2O_8$), but it was Galleski et al. (1999) who formally characterized this as a new species (from the complex-type San Elías pegmatite, Argentina). Tindle, Breaks and Webb (1998) describe potentially new wodginite group species with excess Mn and W which, as yet, await formal recognition by the Commission on New Minerals and Mineral Names.

Excluding the lithian variety, the main wodginite species can be represented in a quadrilateral such as Figure 16a, where ideal compositions occur at the corners of the diagram and the four quadrants define the boundaries between the four wodginite group minerals (Tindle, Breaks and Webb 1998). This diagram effectively summarizes the main A-site (Fe ↔Mn) and B-site (Ti ↔Sn) substitutions.

Wodginite, ferrowodginite, titanowodginite and ferrowodginite occurrences described by Tindle, Breaks and Webb (1998) are all from the Separation Lake area. They are first occurrences for Ontario and because of the economic implications of this mineral group are of major importance (wodginite is the main Ta ore mineral at Tanco mine, Manitoba). Worldwide, titanowodginite had only been described from one Separation Rapids pegmatite (Tindle, Breaks and Webb 1998) and the Tanco pegmatite (Ercit, Černý and Hawthorne 1992c). Wodginite has since been discovered elsewhere in Ontario in another complex type, petalite-subtype pegmatite at Pakeagama Lake, 160 km north of Red Lake (Breaks, Tindle and Smith 1999a, 1999c).

Wodginite group minerals are uncommon in beryl-type pegmatites. Three occurrences have been described previously (Tindle, Breaks and Webb 1998):

1. ferrowodginite from a Fe-suite garnetiferous aplite dike (location 94-15) close to the margin of the Separation Rapids pluton)

2. ferrowodginite from a Fe-suite fluorapatite-garnet-biotite-muscovite potassic pegmatite (Audrey's pegmatite) in close proximity to the petalite zone

3. wodginite from a Mn-suite layered 8 m thick fluorapatite-garnet-biotite-muscovite potassic pegmatite (location 93-265) containing cleavelandite-rich pods with purple lithian muscovite, white beryl, tourmaline, cassiterite, manganocolumbite and (almost end-member) manganotantalite. Wodginite, in appearance similar to cassiterite, forms anhedral or skeletal, dark brown translucent crystals and occurs as inclusions in muscovite. Wodginite crystals are either isolated or form clusters partially replaced by bismutomicrolite and exhibit extreme Mn-enrichment closely matching end-member wodginite in composition (Figure 16a). Many manganese-rich wodginite analyses are tungsteniferous and some have relatively high concentrations of Bi, Pb and U. Concentrations of these minor elements are high where alteration of wodginite to microlite occurs (particularly so if bismutomicrolite is the alteration product).

To these can be added a SW subgroup occurrence of ferrowodginite (inclusions in cassiterite) in a 1 m thick aplite dike (97-69). Two occurrences at the SW margin of the Separation Rapids pluton are also best grouped with these samples. At location 93-260C, a single wodginite inclusion was found in a large cassiterite crystal associated with manganotantalite from a 2 by 3 m cleavelandite rich pod, and, at location 96-72A, wodginite-ferrowodginite co-exists with later crystallizing ferrotapiolite in a quartz-rich garnet-muscovite-beryl potassic pegmatite patch. Perhaps surprisingly, the highest Ta contents in any wodginite species from the Separation Lake area are recorded from this last sample (up to 71.9 wt % $Ta_2O_5$).

Within the Separation Rapids pegmatites, wodginite group minerals appear to be more common in the complex-type, petalite-subtype pegmatites. Thirteen occurrences are documented (Table 5), and of these, eight are from within a 0.5 by 5 km elongate zone that marks the most compositionally evolved part of the eastern subgroup. Most data are of ferrowodginite composition (*see also* Photo 6a) and apart from Marko's pegmatite and one sample from the Big Mack pegmatite, the remaining data are of wodginite composition (Figure 16a). Cassiterite is the oxide most commonly found associated with wodginite and, in some samples, the wodginite occurs only as inclusions in cassiterite grains. Fe- and Mn-columbite and tantalite are also found in most wodginite-bearing samples (± microlite, uranmicrolite, bismutomicrolite, stibiomicrolite, strüverite). However, the oxide assemblages are abundant only in primary albite-rich units or secondary beryl-muscovite-albite assemblages that invariably replace the central petalite-rich cores of some pegmatites. In comparison with their size, wodginite group minerals in both the Big Mack and Big Whopper pegmatites contribute only a minor component to the Ta budget of these pegmatites, and in the SW pegmatite subgroup as a whole, wodginite species are uncommon.

Wodginite group minerals from Marko's pegmatite are described separately, not only because it is the largest petalite-bearing pegmatite of the eastern subgroup pegmatites, but also because it hosts the very rare titaniferous wodginite species (Figure 16a). The cluster of wodginite data (solid diamonds) at the bottom right of Figure 16a represents 12 individual samples collected along the outcrop of Marko's pegmatite and comprise material from both the primary petalite core region and from the secondary muscovite-albite replacement unit of the pegmatite. Wodginite occurs either as translucent (dark brown) or opaque crystals which may be partially altered or rimmed with microlite (Photos 6b and 6c). The layered muscovite - potassium feldspar - quartz pegmatite - aplite units from Marko's pegmatite that crystallized early do not contain wodginite.

The margin of Marko's pegmatite comprises a beryl-muscovite-albite-quartz wall zone which contains metasomatized mica-rich mafic volcanic selvedges. Within the albite, there are rare tabular (pseudo-cubic) crystals of wodginite up to 2 mm across. On Figure 16a, the diagonal trend of data is from a single compositionally zoned crystal with a manganese-rich, tin-rich wodginite core varying to a iron-, titanium-rich ferrotitanowodginite rim. The change in composition is not linear, and the crystal has indistinct core and rim features (Photo 6f) most typical of a replacement origin (Lahti 1987). Also in the wall zone of this pegmatite, there are large cassiterite crystals (up to 8.5 mm long) containing inclusions of strüverite, titanowodginite and ferrotitanowodginite. Photo 6d shows titanowodginite exhibiting oscillatory and truncated zonation, and Photo 6e ferrotitanowodginite with oscillatory zonation, both occurring as inclusions in the same grain of cassiterite. Isolated crystals of grey microlite and yellow-green stibiomicrolite (both considered primary) accompany the cassiterite. There appears to be a continuum of compositions from titanium-rich to iron-rich wodginite compositions (Figure 16a). Within the wall zone of Marko's pegmatite, columbite-tantalite is rarely found.

Tindle, Breaks and Webb (1998) suggest that in Marko's pegmatite, titanowodginite and ferrotitanowodginite owe their origin to a dynamic, disequilibrium process that allowed Ti to be introduced into the pegmatite magma as a result of a metasomatic exchange during or after emplacement, and not as a fundamental consequence of fractionation of an uncontaminated primary melt. The complex patchy zoning, porous nature of the wodginite-ferrotitanowodginite and a reversed fractionation trend (Sn → Ti enrichment) are all best explained by replacement of an earlier wodginite composition rather than by magmatic crystallization. This probably occurred by localized reaction with, or incorporation of, adjacent host rocks with the pegmatitic melt.

Tungsten substitution in wodginite group species was covered in some detail by Tindle, Breaks and Webb (1998), but it is worth revisiting the subject here as more data is now available and substitution schemes can be better defined. For most wodginite group minerals, variation in the A-site is dominated by the 1:1 substitution of Mn by $Fe^{2+}$. Ercit et al. (1992b) report good 1:1 correlation of Mn and Fe, with full site occupancy. At the B-site, the major substitution is of Ti for Sn, but it is not simply a 1:1 substitution. In all data examined, constituents other than Sn and Ti are required to fill the B-site. At the C-site, Nb substitutes for Ta. However, on the basis of 32 oxygens, there is an apparent excess of up to 3.7 (Ta+Nb) cations per unit cell. Ercit et al. (1992b) showed that the excess was Ta occupying the B-site. W was thought to behave like $Nb^{5+}$ and occupy the C-site. Mössbauer spectroscopy was used to show that Fe in the A-site was $Fe^{2+}$ and that lesser amounts of $Fe^{3+}$ reside in the B-site. Voloshin, Pakhomovskii and Bakhchisaraitsev (1990) were further able to show that Li can be incorporated into the A-site based on the coupled substitution of $Mn^{2+} + Sn^{4+} \leftrightarrow Li^{+} + Ta^{5}$.

The complexity of composition in tungsteniferous wodginite from Separation Rapids pegmatites can be illustrated by the backscattered electron and X-ray map (Ti, W and Ta) images of Photos 7, 8 and 9. This complexity and their relatively small grain size are the main reasons why these potentially new species have not been fully characterized.

Most of the A-site variation in wodginite group minerals at Separation Rapids is by $Fe^{2+}$ substituting for Mn. However, data from most of the Separation Rapids pegmatites (open triangles on Figure 16b) show a good correlation between W and $Fe^{3+}$ (estimated on stoichiometric criteria defined by Ercit et al. 1992b) and suggest W in the C site is balanced with $Fe^{3+}$ in the B site according to

$$B[Sn^{4+}] + C[Ta^{5+}] \leftrightarrow B[Fe^{3+}] + C[W^{6+}]$$

This new substitution scheme was described as the "wolframowodginite 1" trend by Tindle, Breaks and Webb (1998) and is particularly pronounced in tungsteniferous wodginite from Fe-suite eastern petalite Pegmatite 5, where $WO_3$ reaches 43.8 wt %. To maintain full charge balance, it is suggested that Li substitutes for Mn in the A site (Figure 16b), and again on stoichiometric criteria, a value of 0.63 wt % $LiO_2$ has been estimated for the extreme composition recorded from Pegmatite 5.

The extreme composition of the tungsteniferous wodginite from Pegmatite 5 has the ideal formula of $(LiMn_3)(Fe^{3+}{}_3Sn)(W_4Ta_4)O_{32}$ and points toward an end-member composition of $(Li_2Mn_2)(Fe^{3+}{}_4)(W_6Ta_2)O_{32}$. In Pegmatite 5, the effect of this substitution is to drop the $Ta_2O_5$ content from 66.0 wt % at the tungsten-poor end of the trend to 22.0 wt % at the tungsten-rich end (Figure 16b; *see also* Figure 17).

In one other pegmatite (eastern subgroup Mn-suite beryl pegmatite from location 93-265), tungsteniferous varieties of wodginite contain very high Mn and require two further mechanisms of substitution be proposed. They produce trends referred to as "wolframowodginite 2" and "wolframowodginite 3" by Tindle, Breaks and Webb (1998). These wodginites have an excess of $Mn^{2+}$ from the A-site, and the excess positive charge due to W at the C-site is balanced by introduction of $Mn^{2+}$ at the B-site through the mechanisms

$$B[Sn^{4+}] + 2C[Ta^{5+}] \leftrightarrow B[Mn^{2+}] + 2C[W^{6+}]$$

$$2B[Sn^{4+}] + C[Ta^{5+}] \leftrightarrow B[Mn^{2+}] + B[Ta^{5+}] + C[W^{6+}]$$

These substitution operators result in hypothetical ideal compositions $Mn^{2+}{}_4(Mn^{2+}{}_2Sn_2)(W_4Ta_4)O_{32}$, and $Mn^{2+}{}_4(Mn^{2+}Sn_2Ta)(WTa_7)O_{32}$, respectively (Tindle, Breaks and Webb 1998). New data suggest $(LiMn^{2+}{}_3)(Fe^{3+}{}_2Sn_2)(W_5Ta_3)O_{32}$ and $Mn^{2+}{}_4(Mn^{2+}{}_3Sn)(W_6Ta_2)O_{32}$ can also be added to the this list (Figure 16b). This latter composition, as represented by an analysis from location 93-265, contains 60.8 wt % $WO_3$ and only 12.7 wt % $Ta_2O_5$ (Figure 17). These trends are poorly defined, but, if more data become available some of the manganese-rich wodginite compositions could define a continuum between "normal" wodginite and wolframite (hubnerite) $Mn^{2+}WO_4$.

## PYROCHLORE GROUP MINERALS

The pyrochlore group comprises a series of cubic oxides containing essential amounts of Nb, Ta or Ti and divide into three subgroups: pyrochlore, betafite and microlite (Figure 18). The general formula of the group is $A_{1-2}B_2O_6(O,OH,F)\cdot nH_2O$ (Mandarino 1999). There are currently 22 species in the group, defined on the basis of A site variation (where A = Na, K, Ca, Sr, Y, Zr, Sn, Sb, Cs, Ba, Ce, Pb, Bi, Th, U) and B site variation (where B = Fe, Nb, Sn, Ta, Ti, W). Nomenclature of the group is given in Hogarth (1977). According to Černý and Ercit (1985), members of this group are possibly the second most abundant phases concentrating Nb and Ta in granitic pegmatites, after columbite-tantalite.

Members of all of the three subgroups, and including 6 distinct species, are represented in the Separation Lake area. These include four members of the microlite subgroup: microlite $(Ca,Na)_2Ta_2O_6(O,OH,F)$, stibiomicrolite $(Sb,Ca,Na)_2(Ta,Nb)_2O_6(O,OH,F)$, uranmicrolite $(U,Ca)_2(Ta,Nb)_2O_6(O,OH,F)$ and bismutomicrolite $(Bi,Ca)_2(Ta,Nb)_2O_6(OH)$. Antimonian microlite intermediate in composition between microlite and stibiomicrolite is also found. Additionally, stibiobetafite $(Sb,Ca)_2(Ti,Nb,Ta)_2(O,OH)_7$ and yttropyrochlore $(Y,Na,Ca,U)_{1-2}(Nb,Ta,Ti)_2(O,OH)_7$ are also found. Uranmicrolite, bismutomicrolite, stibiobetafite and yttropyrochlore are all rare occurrences. The $Ta_2O_5$ contents of these species are listed in Table 6.

Pyrochlore group minerals do not occur in the Separation Rapids pluton (although microlite is reported from a miarolitic cavity in the Treelined Lake complex), or those pegmatites with ferrocolumbite and ferrotantalite compositions whose Mn/(Mn+Fe) ratios are less than 0.3. Futhermore, occurrence of microlite does not correlate with the presence of either beryl or petalite. Of all the microlite subgroup species, microlite is the one found most commonly, e.g., in four SW subgroup beryl pegmatites (Wolf pegmatite, and locations 96-9, 96-25A, EFR-6056B), an eastern subgroup beryl pegmatite (location 93-265), three SW petalite subgroup pegmatites (School of Fish, Zone 11 and Big Whopper pegmatites) and, more commonly, in two eastern subgroup petalite pegmatites (Pegmatite 7 and Marko's pegmatite). Stibiomicrolite is quite rare, being found in two eastern subgroup petalite pegmatites (Lou's and in the wall zone of Marko's pegmatite). Bismutomicrolite was only found in an eastern subgroup beryl pegmatite from location 93-265, whereas uranmicrolite and yttropyrochlore are restricted to Pegmatite 5 in the eastern subgroup and the Big Whopper pegmatite in the SW subgroup, respectively, both are petalite pegmatites. Stibiobetafite has the most restricted occurrence of all, being found in the wall zone of Marko's pegmatite at the actual contact with its host rock: a metasomatized garnet-biotite-plagioclase metavolcanic rock.

Microlite is a strongly associated with muscovite-lepidolite, with most microlite crystals being included within, in contact with, or adjacent to muscovite-lepidolite crystals. Microlite typically forms mottled, irregularly shaped, inclusion-rich crystals that partially or totally replace earlier ferrowodginite, or wodginite (rarely manganocolumbite). In Marko's pegmatite, the presence of microlite after wodginite (Photo 6c) and small inclusion-free cassiterite growing from within the microlite outward beyond the original margin of the wodginite suggests a reaction involving the following exchange

$$\text{wodginite} + (\text{Ca, Na, F})\text{-rich “fluid”} \rightarrow \text{cassiterite} + \text{microlite}$$

$$MnSnTa_2O_8 + (Ca+Na+F) \rightarrow SnO_2 + (Ca,Na)_2Ta_2O_6F + (Mn)$$

Photo 6b provides evidence that the Ca, Na and F components of this “fluid” became concentrated enough to react late in the crystallization sequence. Here, a euhedral wodginite crystal, mainly enclosed in a muscovite crystal has been totally replaced at one end by microlite prior to being partially included within albite (muscovite and albite are not visible in this backscattered electron image). One sample from a muscovite-albite replacement unit within the petalite core zone of Marko's pegmatite hosts abundant microlite with a particularly complex history. Large anhedral crystals of microlite up to 2.5 mm in length are found containing elongate inclusions of manganotantalite (the most manganiferous from this pegmatite) rimmed by a ferrocolumbite alteration rim (Photo 3e). Such microlite crystals often contain numerous oriented ferrocolumbite inclusions that form fan-shaped patterns or a myrmekitic texture. Certain zones of these crystals are either porous and rich in inclusions or non-porous with larger, more discrete inclusions. Most inclusions show some oscillatory zoning.

Whereas microlite is closely associated with Li mica, stibiomicrolite and antimonian microlite tend to occur associated with cassiterite and wodginite. Stibiomicrolite is pale yellow in colour and is usually found as inclusions in, or in contact with, cassiterite. Exceptions include a stibiomicrolite at the margin of a ferrotitanowodginite crystal and a stibiomicrolite partially replacing a wodginite crystal included in quartz. A stibiomicrolite inclusion in cassiterite from the wall zone of Marko's pegmatite clearly replaces ferrotitanowodginite (Photo 10a). However, in another sample from the same unit, a large (0.5 mm), oscillatory zoned antimonian microlite crystal has grown against an earlier cassiterite containing titanowodginite and ferrotitanowodginite inclusions and is most likely primary (Photo 10b). This crystal has an antimony-rich core ($Sb_2O_3 = 9.9$ wt %) and the Sb content decreases outwards to antimonian microlite compositions with $Sb_2O_3 = 3.6$ wt %. Other microlite subgroup crystals have much higher Sb contents (e.g., Marko's pegmatite with 20.91 wt % $Sb_2O_3$, which exceeds the necessary 20 atomic% Sb in the A site required to name the mineral as true stibiomicrolite (Hogarth 1977; Groat, Černý and Ercit 1987). In Lou's pegmatite (an eastern subgroup Fe-suite petalite pegmatite), oscillatory zoned stibiomicrolite inclusions in cassiterite are near euhedral with a form reminiscent of wodginite. These, too, are most likely primary occurrences.

Microlite subgroup minerals show little systematic variation within an individual pegmatite, but there are differences between pegmatites, however, the wall zone of Marko's pegmatite hosts a suite with compositions ranging from microlite (0.2 to 4.6 wt % $Sb_2O_3$) to antimonian microlite (3.8 to 10.5 wt % $Sb_2O_3$) and stibiomicrolite (9.9 to 12.7 wt % $Sb_2O_3$). It is apparent from these data (and, to a lesser extent, the data from Lou's pegmatite) that there is a continuum of compositions from microlite to stibiomicrolite and that if Ti contents are high, so too is the Sb content. Even higher Sb contents are found in stibiobetafite. Most other pyrochlore group-bearing pegmatites have relatively low Sb contents and their data plot near the origin of Figure 19, a useful classification diagram for antimony- and titanium-rich pyrochlore group minerals. Increasing Sb and Ti contents are at the expense of Ta, which drops to a mean value of 21.8 wt % $Ta_2O_5$ in stibiobetafite (Table 6), down from a mean value of 72.3 wt % $Ta_2O_5$ in microlite from Marko's pegmatite.

Stibiobetafite has the highest Sb concentrations (and one of the lowest Ta contents) of all the pyrochlore group minerals found at Separation Rapids (16.7 to 25.3 wt % $Sb_2O_3$), but is only found in the wall zone of Marko's pegmatite. Photo 11 illustrates stibiobetafite in which pyrochlore group mineral crystallization appears to have been a three-step process. Manganocolumbite has been replaced by microlite, which, in turn, is replaced by stibiomicrolite. The final step of the process is the crystallization of oscillatory zoned stibiobetafite on the stibiomicrolite. Perhaps because of a change in volume as manganocolumbite was replaced by microlite or because some stibiomicrolite was dissolved away first, much of the stibiobetafite was able to grow in open space to form partially euhedral crystals.

As with the wodginite to microlite transformation, the sequence of reactions leading to crystallization of stibiobetafite requires an initial influx of Ca, Na and F, that is followed later by an influx or exchange with a source rich in Ti and Sb

manganocolumbite + (Ca, Na, F)-rich "fluid" → microlite

$$(Mn,Fe)(Nb,Ta)_2O_6 + (Ca+Na+F) \rightarrow (Ca,Na)_2(Ta,Nb)_2O_6(OH,F) + (Fe+Mn) \qquad [1]$$

microlite + Ti, Sb source → stibiomicrolite

$$(Ca,Na)2(Ta,Nb)2O6(F) + (Ti+Sb) \rightarrow (Sb,Ca)2(Ta,Nb,Ti)O6(OH,F) + (Ca,Na,F) \qquad [2]$$

stibiomicrolite + Ti, Sb source → stibiobetafite

$$(Sb,Ca)_2(Ta,Nb,Ti)O_6(OH,F) + (Ti+Sb) \rightarrow (Sb,Ca)_2(Ta,Nb,Ti)_2(O,OH)_7 + (Ca,Na,F) \qquad [3]$$

A Ca, Na, F "fluid" is a likely constituent involved in albitization, which probably developed toward the end of the pegmatite crystallization. However, as the stibiobetafite only occurs at the actual margin of the wall zone of Marko's pegmatite, it is reasonable to assume the Ti and Sb came from the host rocks.

Uranmicrolite has been observed in two samples from an eastern subgroup Fe-suite petalite pegmatite (Pegmatite 5), where it occurs as small (approx. 50 µm), weakly zoned, inclusions in ferrowodginite (Photo 10c). Uranmicrolite has euhedral form, is yellowish brown in colour and appears to be an early crystallizing primary phase. Low analytical totals are thought to indicate a high water content and petrographic evidence in the form of radial fractures typical of radiation damage due to volume expansion indicate the crystal is metamict or nearly so. Other locations where U in microlite is relatively high include parts of Marko's pegmatite (2.4 to 7.1 wt % $UO_2$) and the Big Whopper pegmatite (5.2 to 8.6 wt % $UO_2$), this compares with 13.2 to 16.6 wt % $UO_2$ in uranmicrolite from Pegmatite 5.

Bismutomicrolite is a rare mineral that occurs in the most evolved, Mn-suite beryl pegmatite (location 93-265) in association with large cleavelandite-Li mica-enriched pods. It forms as a late-stage alteration product of tungsteniferous wodginite where it selectively replaces zone boundaries and individual zones of the wodginite. The mineral has a mottled appearance and is dissected by many cracks. Although the mineral contains much less U than uranmicrolite, it appears to be affected by metamictization. The very low analytical totals are thought to reflect a high water content.

Yttropyrochlore has only been found in one sample: a SW subgroup petalite pegmatite (96-29; Photo 10d). A 150 µm long relict core of yttropyrochlore composition ($Y_2O_3$ = 18.6 to 20.9 wt %) is mantled by an alteration rim with a much lower yttrium content ($Y_2O_3$ = 4.2 to 5.7 wt %) and high Si content ($SiO_2$ = 3.5 to 6.2 wt %). The source of Y is unknown, but possibilities include it being concentrated during magmatic fractionation to form primary yttropyrochlore or that some xenotime, which had crystallized out from the pegmatitic melt, was later dissolved by albitizing fluids and the mobilized Y was then available to form yttropyrochlore. Further discoveries are required before this can be unravelled.

## CASSITERITE

Cassiterite is common at Separation Rapids, occurring in all pegmatite types. Although its modal abundance is quite variable, it is frequently the most common oxide present. In much of the Separation Rapids pluton, it is either absent or rare, although crystals up to 3 mm across have been found in the more evolved southwestern part of the intrusion. Of 31 beryl pegmatites examined, 17 have been found to contain cassiterite, albeit in low abundance; the exception being Mn-suite beryl pegmatite from location 93-265, where cassiterite is more common and where crystals up to 2 cm in length have been found.

It is in the petalite pegmatites where cassiterite occurs in the greatest abundance. In the eastern subgroup, Pegmatite 7, a Fe-suite pegmatite is particularly enriched, with visual estimates of modal abundance reaching 3 to 5% in fluorapatite-zircon-rich zones. Notable enrichment also occurs in both Pegmatite 10, Lou's and Marko's pegmatites (also members of the eastern subgroup) and at the margin of a Zone 11 pegmatite (part of the Big Mack system in the SW subgroup). However, cassiterite was not found in Pegmatites 1 and 8, and abundances are quite low in Pegmatites 6, 9 and 11. In the SW subgroup, all the main pegmatites, that is, Pegmatites 12 and 14, Big Mack, Big Whopper (especially 97-BW7B), Glitter (especially 99-GZ4), Great White North, School of Fish, Swamp and West pegmatites, contain cassiterite (Table 7), but (with a few exceptions) never in great abundance.

Cassiterite commonly forms euhedral, diamond-shaped crystals up to 1.2 cm in length (but more commonly 0.2 to 0.4 mm in Pegmatites 6, 9 and 11) and exhibits a wide variety of colours in thin section from dark brown (almost black) through deep reddish brown, medium brown, pale brown, to a straw-yellow brown. In some samples, all these colours occur in a single crystal in a series of variably spaced concentric zones. Cassiterite from the Separation Rapids pluton and Fe-suite beryl pegmatites are relatively free of inclusions. However, in the Fe-suite petalite pegmatites, it is not unusual for the darker core regions to be relatively inclusion free and for a later, lighter brown zone to contain trains of small ferrocolumbite inclusions near the boundary between the two zones. Where multiple zones occur (e.g., beryl pegmatite from location 94-15), there is alternation between ferrocolumbite- and pore-rich zones and other zones lacking inclusions, but full of dark, needle-shaped exsolution products (possibly rutile; Photo 10e).

Cassiterite in the petalite pegmatites host many inclusions including; scandium-rich ixiolite (Photo 5a), ferrocolumbite (Photos 1d and 10e), ferrotantalite and ferrotapiolite (Photo 4b), ferrowodginite and strüverite (Photo 5c), tungsteniferous wodginite (Photo 7), microlite, stibiomicrolite (Photo 10a) and rarely löllingite and uraninite. In the wall zone of Marko's pegmatite, cassiterite hosts inclusions of titanowodginite (Photo 6d) and ferrotitanowodginite (Photo 6e). Cassiterite from the Glitter pegmatite, a SW subgroup beryl pegmatite, perhaps contains the highest inclusion density with, ferrocolumbite (mainly), ferrotantalite and ferrotapiolite all observed (Photo 10f). Cassiterite can also be inclusion free as in the petalite core zone of Marko's pegmatite, where it forms euhedral crystals often associated with manganocolumbite and microlite (Photos 3e and 3f). In this, and the majority of other occurrences, cassiterite is one of the last, if not the last, oxide minerals to crystallize.

Overall, cassiterite has a limited range of compositions and there is considerable overlap in FeO, MnO, $Nb_2O_5$ and $Ta_2O_5$ contents between rock types. Of these elements, Ta concentrations are highest and range from 0.3 to 2.3 wt % $Ta_2O_5$ in the evolved part of the pluton, 0-9.4 wt % in the beryl pegmatites (although only 5 out of 182 analyses have $Ta_2O_5 > 5$ wt %), and 0-11.0 wt % in the petalite pegmatites (64 out of 915 analyses have $Ta_2O_5 > 5$ wt %). The highest $Ta_2O_5$ contents are concentrated in three of the petalite pegmatites: Pegmatite 5 (max. 11.0 wt % $Ta_2O_5$), Pegmatite 6 (max. 9.1 wt % $Ta_2O_5$) and Pegmatite 10 (max. 10.3 wt % $Ta_2O_5$), all outcropping in close proximity to one another in the eastern subgroup. Other high values are recorded in Pegmatite 7, Marko's pegmatite, Great White North pegmatite, and the Big Whopper pegmatite.

Because of the problem of inclusions within the cassiterite, great care was taken in setting up analysis points, frequently using backscattered electron images in addition to conventional reflected and transmitted light optics. This investigation revealed common oscillatory zonation as well as sector zoning. In a few samples, Ta concentration could be related to structural features in the cassiterite (Photo 12) or to multiple episodes of crystallization (Photo 13). In all cases, low Ta cassiterite was the final product. In Photo 14, an earlier generation of tantalum-rich cassiterite is being replaced by a low Ta cassiterite and, in the process, the excess Ta is ejected from the cassiterite structure to form blobs of ferrotapiolite (white spots in Photos 14a, 14c and 14d).

Chemical composition seems related to the colour of the cassiterite; in the petalite pegmatites, the darker zones typically have $Ta_2O_5$ contents of 4 to 10 wt %, whereas in the lighter zones they are nearer 1.5 wt %. There does not appear to be a systematic variation in cassiterite composition between rock types, but the bulk of the data fall along a linear array with Nb+Ta and Fe+Mn predominantly varying in the ratio of 2:1 corresponding to the coupled substitution: $3\ Sn^{4+} \leftrightarrow 2(Nb,Ta)^{5+} + (Fe,Mn)^{2+}$ (Figure

20). This relationship is common to cassiterite from many rare-element granites and pegmatites worldwide and distinctly different to those from epithermal and hydrothermal vein deposits (Tindle and Breaks 1998). Additionally, cassiterite compositions approaching the 1:1 substitution line on Figure 20 suggest a $Fe^{3+}(Nb,Ta)O_4$ component in a few of the cassiterite analyses, consistent with the substitution: $2Sn^{4+} \leftrightarrow Fe^{3+} + Ta^{5+}$ (Černý and Ercit 1989).

## COMMODITY IMPORTANCE OF OXIDE MINERALS IN RARE-ELEMENT PEGMATITES

Many of the oxide minerals documented in this report represent potentially important ore minerals for tantalum, a metal of growing economic status. Furthermore, subordinate amounts of niobium and tin occur in many of the oxide minerals, which could add value to concentrates produced from future exploitation of pegmatite deposits from the Separation Lake area. At the Greenbushes Mine in Australia, tin ingots are produced which help defray mining and milling costs (Sons of Gwalia Limited website: www.sog.com.au). Concentrate produced at the Tanco Mine contains 5 to 8% $Nb_2O_5$ and 14 to 18% $SnO_2$ (Černý, Ercit and Vanstone 1996). Prices for various types of commodities for these metals are given below.

| Commodity | Metal content (wt %) | Price (US$/pound or kg) | Ref. |
|---|---|---|---|
| Tantalum-rich concentrate | Tanco Mine, Manitoba:<br>35-38% $Ta_2O_5$<br>14-18% $SnO_2$<br>5-8% $Nb_2O_5$ | Range of spot price from three published sources in 1999:<br>$28–45 per pound of $Ta_2O_5$ | 1, 2 |
| Capacitor-grade tantalum metal powder | | $135–260 per pound tantalum metal | 2 |
| Tantalum capacitor wire | | $180–270 per pound tantalum metal | 2 |
| Vacuum-grade tantalum metal for superalloys | | $75–100 per pound tantalum metal | 2 |
| Tantalum scrap clips | | $100–114 per pound tantalum metal (April 25, 2000) | 3 |
| Tantalum sheet metal | | $100–150 per pound tantalum metal | 2 |
| Niobium-rich concentrate | | $2.80–3.20 per pound of $Nb_2O_5$ | 2 |
| Steel-making grade ferrocolumbium | | $6.75–7.00 per pound niobium metal | 2 |
| High-purity ferrocolumbium | | $17.50–18.00 per pound niobium metal | 2 |
| Tin ingots | | $5.50 per kg | 4 |

**References:** 1 Černý, Ercit and Vanstone (1996);
2 United States Geological Survey, Mineral Commodity Summaries, February 2000: www.mineral.usgs.gov/minerals/pubs;
3 http://nickelalloy.com/newsletter1.htm;
4 *The Northern Miner*, March 6, 2000, Section on Metal Prices.

New markets developed over the past two decades have elevated tantalum from a contaminant in the processing of tin ores to a valuable resource (*The Northern Miner* 1999). The main source of tantalum has traditionally originated from tin-bearing slags as in Malaysia and Thailand. However, there has been an increasing shift of tantalum production to hard-rock ores (rare-element pegmatites and granites), which currently comprise about 40% of the annual global output of 4 million pounds (Solman 1999). Australia is the largest producer of tantalum, where Sons of Gwalia Limited recorded 929 000 pounds of tantalum from its Greenbushes and Wodgina Mines in 1999 (Solman 1999).

Industrial uses of tantalum are diverse and relate to important physical features of the metal: high resistance to corrosion, high melting temperature (3015°C, only exceeded by tungsten and rhenium) and exceptional electrical capacitance and alloying characteristics. The electronics industry accounts for the largest consumption (60%) where tantalum is used extensively for manufacture of high-quality capacitors for computers, mobile phones, automobile electronics, pagers and video cameras. Demand for tantalum capacitors has been growing at 10% per annum since 1992 and production is projected to reach a rate of 25 billion units per year in 2000 (Roskill Information Services 1999). Other important uses of tantalum are in the aerospace industry (super-alloys with nickel and copper), metal-cutting (tantalum carbide tools), and the chemical and pharmaceutical industries. Niobium is mainly used in the manufacture of stainless steel and improves resistance to corrosion.

## GRADES AND TONNAGES OF TANTALUM DEPOSITS

Listed below are several important tantalum deposits currently being mined in addition to prospects that could represent future production of the metal. This section is intended to inform explorationists and prospectors in regards to grades and tonnages that typify tantalum deposits. One pound of $Ta_2O_5$ is equivalent to 0.05% $Ta_2O_5$.

1. Tanco Mine, southeastern Manitoba (Černý, Ercit and Vanstone 1996). This deposit represents one of the highest grade tantalum deposits ever mined, but is apparently now depleted of its high-grade reserves. Pre-production reserves: 2.07 million tonnes averaging 0.216% $Ta_2O_5$ or 2169 g/t = 9.8 million pounds. Up to 135 000 pounds of tantalum per year are produced mainly from reprocessing of tailings.
2. Greenbushes Mine, Western Australia (Sons of Gwalia Limited website: www.sog.com.au). This high-tonnage–low-grade tantalum deposit is currently the largest producer of tantalum in the world. Total 1999 production from Greenbushes and Wodgina mines: 929 000 pounds or approximately 1/3 world's supply. Resource size: 160 million tonnes averaging 0.0214% $Ta_2O_5$ or 214 g/t = 75 million pounds. High-purity spodumene concentrates also produced from this mine.
3. Wodgina Mine, Western Australia (Sons of Gwalia Limited website: www.sog.com.au). First primary tantalum-producing mine in Australia. Resource size: 35 million tonnes averaging 0.0402% $Ta_2O_5$ or 402 g/t = 31 million pounds.
4. Morrua deposit, Mozambique (Cabot Corporation website: www.cabot-corp.com). This deposit contains 4.57 million tonnes of tantalum ore and surface dump reserves of 1.4 million tonnes of unspecified grade. Potential production of 300 000 to 400 000 pounds of tantalum per year.
5. Big Whopper pegmatite, northwestern Ontario (Avalon Ventures Limited website: www.avalonventures.com). Resource: 7.087 million tonnes averaging 0.007% $Ta_2O_5$ or 70 g/t = 1.1 million pounds.
6. Pakeagama Lake pegmatite, northwestern Ontario (Breaks, Tindle and Smith 1999a, 1999c). Early stage exploration target with promising tantalum values on surface of highly evolved pegmatite with characteristics similar to Tanco pegmatite. Channel samples by Houston Lake Mining Inc. (Press release, November 29, 1999) revealed 285 g/t of $Ta_2O_5$ across 11 m and a maximum of 620 g/t in late-stage replacement units. Bulk samples by the Ontario Geological Survey revealed a similar range of 0.02 to 0.07% $Ta_2O_5$ (Breaks, Tindle and Smith 1999b).

# EXPLORATION FOR TANTALUM MINERAL-BEARING PEGMATITE DEPOSITS

The various tantalum-, niobium-, and tin-bearing oxide phases described in the report are commonly overlooked during exploration as they are virtually impossible to verify in the field. Identification requires refined X-ray diffraction work and/or electron microprobe analysis. Difficulty in recognition in the field is in part due to the following

1. fine grain size
2. low modal abundance (for example, an economic tantalum deposit could comprise 0.1 to 0.3 modal percent tantalite)
3. complex intergrowths that involve several tantalum-, niobium- and/or tin-bearing minerals can comprise a single oxide grain
4. general absence of characteristic colours; most oxide phases in the Separation Lake area are black.

In order to aid explorationists and prospectors in locating pegmatites that could host tantalum-bearing minerals, reference to Černý (1989a, 1989b) and Breaks and Tindle (1997, p.13-22) is recommended. Of specific importance is the chemistry of indicator minerals, potassium feldspar and muscovite.

## Potassium feldspar chemistry

This mineral has been established as an important geochemical tool in the economic evaluation of pegmatite deposits (e.g., Černý 1989b, p.288-291). In particular, the Rb and Cs contents and the K/Rb ratio in potassium feldspar can discriminate between various types of rare-element pegmatites and those that are barren of rare elements. Such data are normally assessed in the Cs versus K/Rb plot devised by Černý et al. (1981), whose extensive work in the Cat Lake – Winnipeg River pegmatite field established boundaries between various geochemical assemblages of rare-element class pegmatites: Be-, Li-Be and Li-Cs-Rb-Ta. Application of this diagram to Ontario rare-element pegmatites can be found in Breaks and Tindle (1997, p. 16) and Breaks, Tindle and Smith (1999a, p.175).

## Muscovite chemistry

The Ta, Nb and Cs contents of primary muscovite are particularly useful in assessing the potential presence of tantalum- and niobium-bearing oxide minerals (Odikadze 1958; Heinrich 1962; Beus 1966; Gordiyenko 1971). Gordiyenko (1971) concluded that muscovite from tantalum-rich pegmatites typically exceeds 70 to 90 ppm, whereas columbite-bearing pegmatites are characterized by high Nb levels in the muscovite (200 ppm).

Pegmatites that contain evolved tantalum minerals such as wodginite and manganotantalite, are invariably of the complex-type (Černý 1989a). Such pegmatites would also likely be characterized by elevated bulk cesium levels which is most easily accommodated in the muscovite crystal structure. This observation led Morteani and Gaupp (1989) to advocate the Ta versus Cs diagram as a means of predicting which pegmatites contain tantalum-rich oxide phases. Muscovite from the Tanco pegmatite, for example, contains 900 to 9000 ppm Cs and 70 to 900 ppm Ta (Morteani and Gaupp 1989, p.306). Muscovite from complex-type pegmatites of the Separation Lake area reveal Cs and Ta concentration ranges of 70 to 300 ppm and 100 to 3000 ppm, respectively (A.G. Tindle and F.W. Breaks, unpublished data, 1999).

# SUMMARY

An investigation into the Ta mineralization of the Separation Lake area has revealed a wide range of Ta species which include: ferrocolumbite, ferrotantalite, manganocolumbite, manganotantalite, ferrotapiolite, ixiolite, strüverite, wodginite, ferrowodginite, titanowodginite, ferrotitanowodginite, microlite, bismutomicrolite, stibiomicrolite, stibiobetafite, uranmicrolite, yttropyrochlore, cassiterite and a potentially new species—a tungsteniferous variety of wodginite. Of these, the columbite-tantalite group and cassiterite represent the most widely distributed species, closely followed by wodginite group species (in the eastern subgroup pegmatites). Ixiolite, strüverite and most of the pyrochlore group species are of very restricted occurrence, but localized concentrations of ferrotapiolite or microlite could be of economic interest as these two minerals have high $Ta_2O_5$ contents. For example, a 30 cm thick albitite dike at location 96-9 contains a bulk $Ta_2O_5$ of 0.16% (Breaks and Tindle 1997, p.11) that is due to a relatively high tapiolite content.

Zonation and variation of $Ta_2O_5$ in individual species and between individual pegmatites is often pronounced and on the basis of columbite-tantalite compositions two distinct groupings have emerged: an Fe-suite and a less common Mn-suite. The difference is thought to be due to fluorine activity in the parental magmas of the pegmatites, with Mn-suite pegmatites, in particular those with lepidolite characteristics having the greatest fluorine activity. Columbite-tantalite compositions are also consistent with the model that the ultimate parent of the pegmatites (and the rare elements) is the Separation Rapids pluton.

A comparison of columbite-tantalite compositions in the two giant Separation Rapids pegmatites suggests the Big Mack pegmatite may be a precursor to the Big Whopper pegmatite. In both pegmatites, the Ta content of columbite-tantalite is elevated (to 63.5 wt % $Ta_2O_5$ in the Big Mack and 76.4 wt % $Ta_2O_5$ in the Big Whopper) due to protracted fractionation. Similar to other pegmatites of the SW subgroup, they contain a paucity of wodginite group minerals.

Most wodginite group minerals can be considered to be the highly evolved products of two distinct, but possibly related, rare-element oxide fractionation paths. The Separation Rapids granite and most eastern Fe-suite beryl and petalite pegmatites evolved through the sequence ferrocolumbite → ferrocolumbite + ferrowodginite →ferrotantalite + ferrowodginite →pyrochlore group minerals, whereas the Mn-suite pegmatites such as Marko's followed an evolutionary trend from manganocolumbite → manganocolumbite + wodginite →manganotantalite + wodginite →pyrochlore group minerals.

Wodginite group data from Marko's pegmatite include the extremely rare titanowodginite and ferrotitanowodginite species, whereas in Pegmatite 5 data has been collected on a potentially new tungsteniferous species of wodginite.

The field classification of the pegmatites into beryl-type and complex-type, petalite-subtype pegmatites is fully supported. In contrast to chemical data from Separation Rapids potassium feldspar samples (Breaks and Tindle 1997), chemical differences in columbite-tantalite do not produce distinct groupings as might be expected if the beryl pegmatites were early fractionates of a parental magma that went on to produce petalite pegmatites later in its history. Whatever the reason, fractionation of these two pegmatite types produced columbite-tantalite with essentially the same ranges of composition (with the exceptions of the low $X_{Mn}$, ferrotapiolite-bearing pegmatites). These include all beryl-type pegmatites and the Swamp pegmatite and the lepidolite unit of the Big Whopper pegmatite, the latter two of which span the gap between petalite-subtype pegmatites and lepidolite-subtype pegmatites). Petalite pegmatites do, however, have a greater propensity to crystallize wodginite and pyrochlore group minerals, which in this respect makes them more evolved than the beryl pegmatites.

## ACKNOWLEDGMENTS

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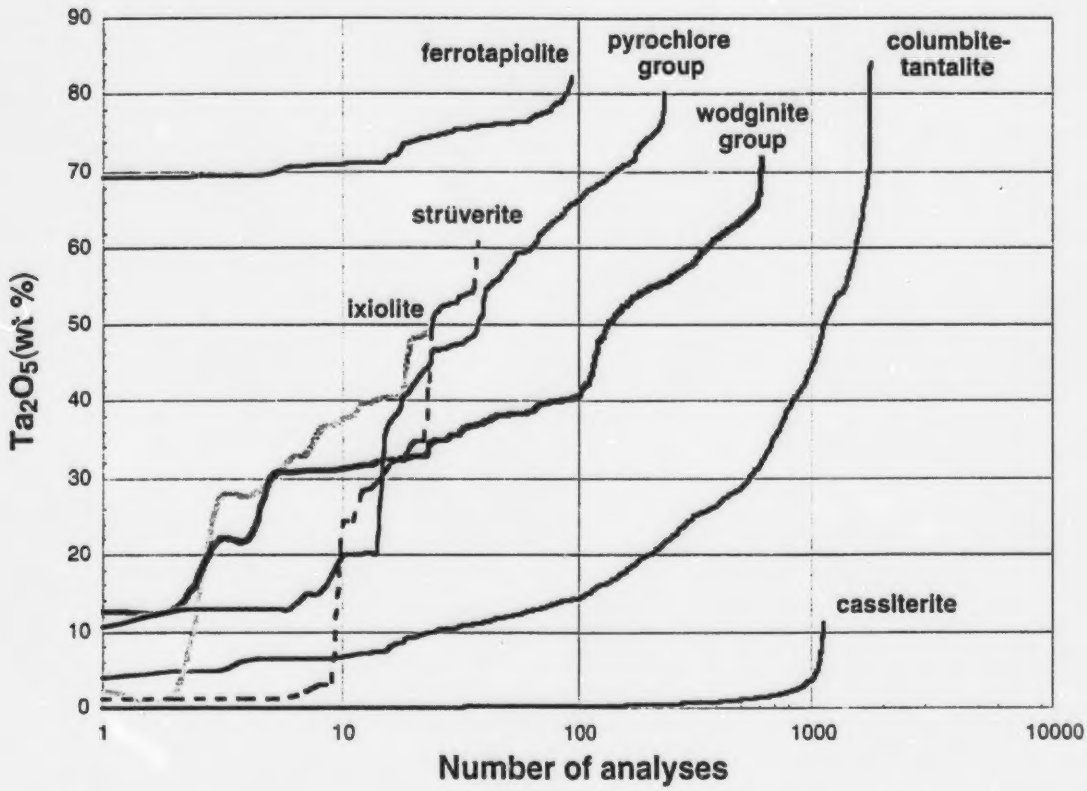

**Figure 1.** Number of analyses versus $Ta_2O_5$ illustrating the dominance of the columbite-tantalite group and cassiterite and the high $Ta_2O_5$ concentrations in the columbite-tantalite group, wodginite group, pyrochlore group and ferrotapiolite.

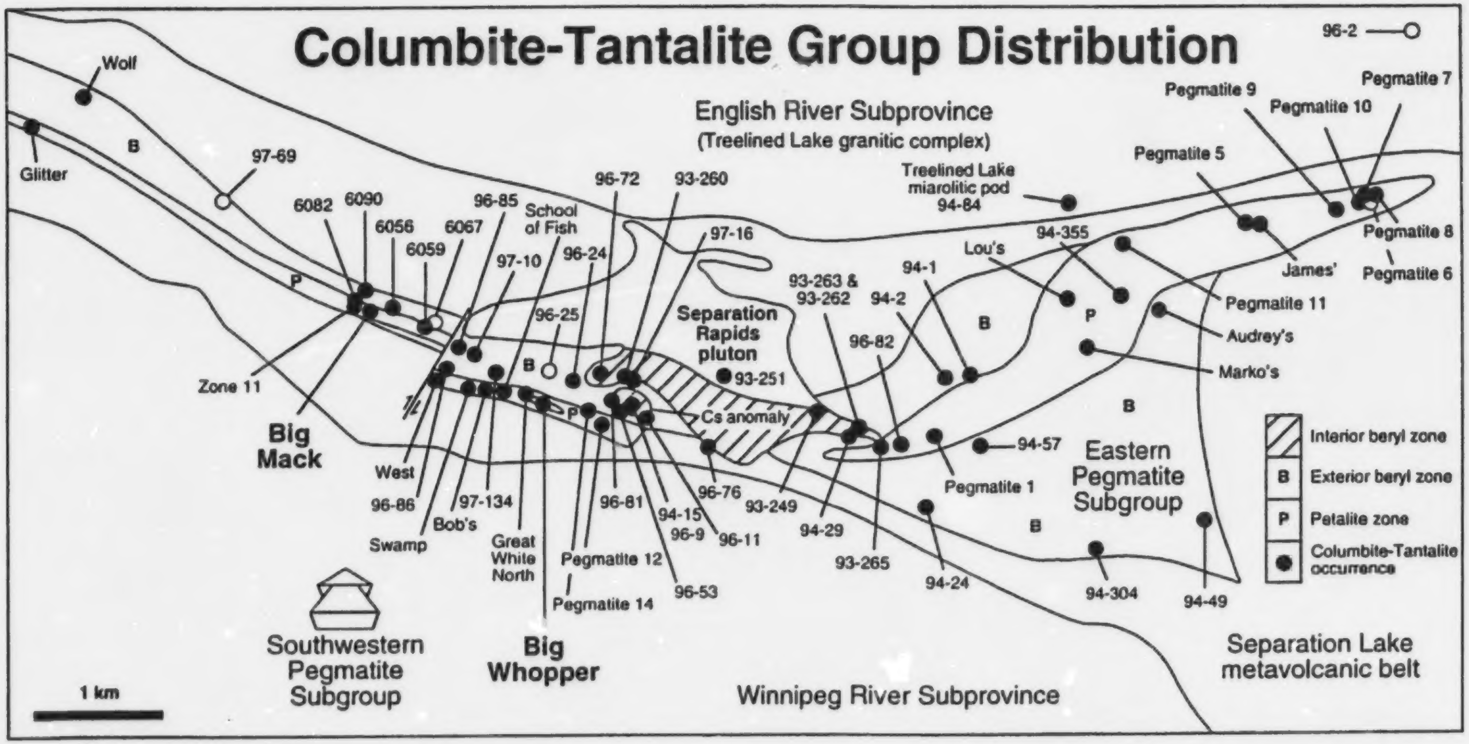
Columbite-Tantalite Group Distribution
96-2
Pegmatite 7
Pegmatite 9
Pegmatite 10
Pegmatite 5
Pegmatite 8
Pegmatite 6
James'
Pegmatite 11
Audrey's
Marko's
English River Subprovince
(Treelined Lake granitic complex)
Treelined Lake miarolitic pod 94-84
94-355
Lou's
94-1
93-263 &
93-262
94-2
96-82
B
P
Wolf
Glitter
B
97-69
6082
6090
6056
6067
6059
96-85
School of Fish
97-10
96-24
96-72
93-260
97-16
96-25
B
Separation Rapids pluton
93-251
Cs anomaly
P
Zone 11
Big Mack
West
96-86
Swamp
97-134
Bob's
Great White North
96-81
Pegmatite 12
Pegmatite 14
94-15
96-9
96-11
96-76
96-53
93-249
94-29
93-265
94-24
Pegmatite 1
94-57
Eastern Pegmatite Subgroup
B
B
94-304
94-49
Interior beryl zone
Exterior beryl zone
Petalite zone
Columbite-Tantalite occurrence
Southwestern Pegmatite Subgroup
Big Whopper
1 km
Winnipeg River Subprovince
Separation Lake metavolcanic belt

**Figure 2.** Columbite-tantalite group distribution map.

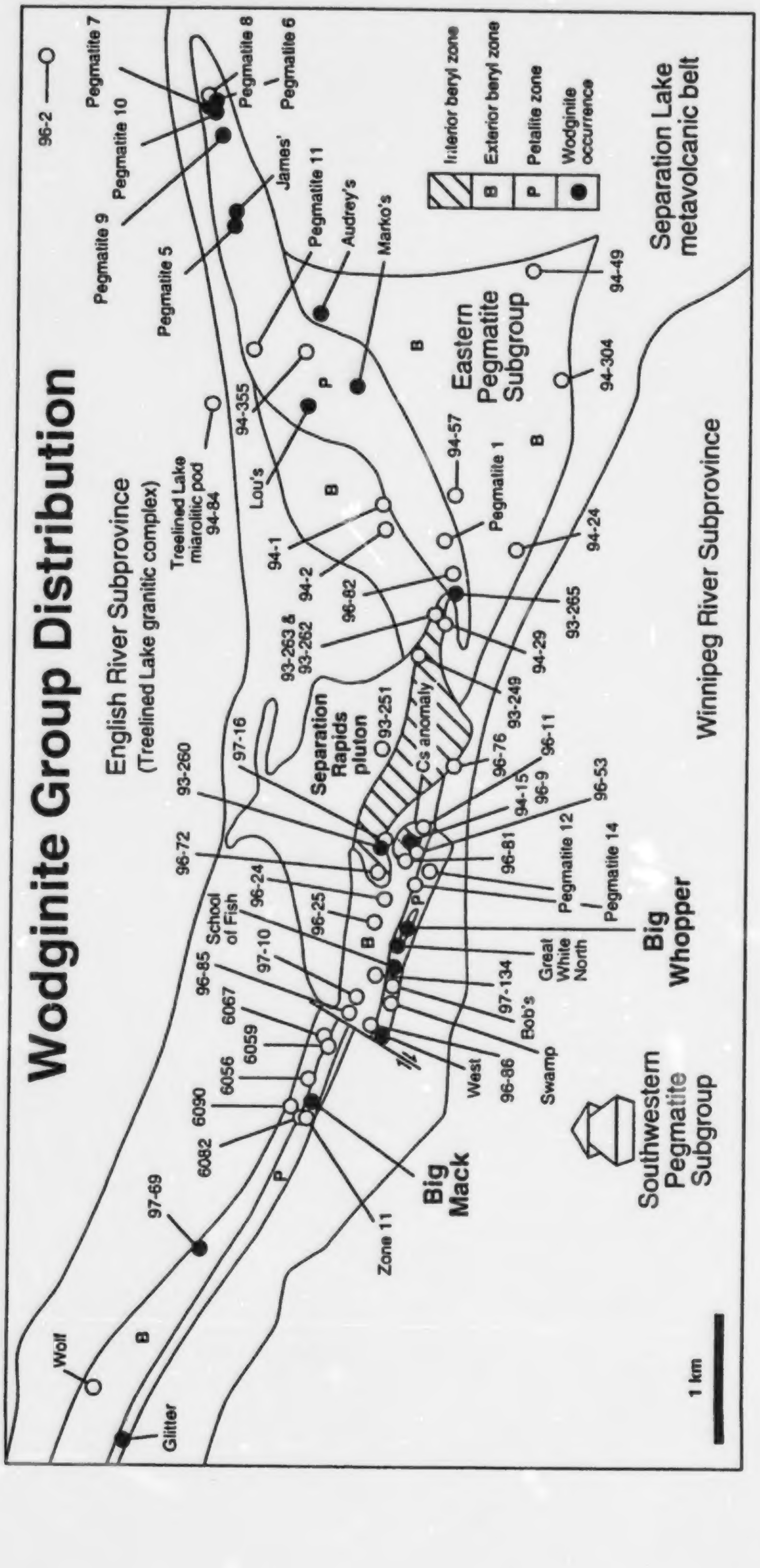
Wodginite Group Distribution
English River Subprovince
(Treelined Lake granitic complex)
Treelined Lake miarolitic pod 94-84
Separation Rapids pluton
Cs anomaly
Eastern Pegmatite Subgroup
Southwestern Pegmatite Subgroup
Separation Lake metavolcanic belt
Winnipeg River Subprovince
Big Mack
Big Whopper
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Wodginite occurrence
96-2
Pegmatite 7
Pegmatite 8
Pegmatite 6
Pegmatite 10
Pegmatite 9
Pegmatite 5
James'
Pegmatite 11
Audrey's
Marko's
94-49
94-304
94-355
Lou's
94-57
Pegmatite 1
94-1
94-2
96-82
94-24
93-263 &
93-262
93-265
94-29
93-249
97-16
93-251
96-76
96-11
93-260
96-72
94-15
96-9
96-53
96-81
Pegmatite 12
Pegmatite 14
School of Fish
96-24
96-25
Great White North
97-134
Bob's
96-85
97-10
6067
6059
6056
6090
6082
West
96-86
Swamp
97-69
Zone 11
Wolf
Glitter
1 km

Figure 3. Wodginite group distribution map.

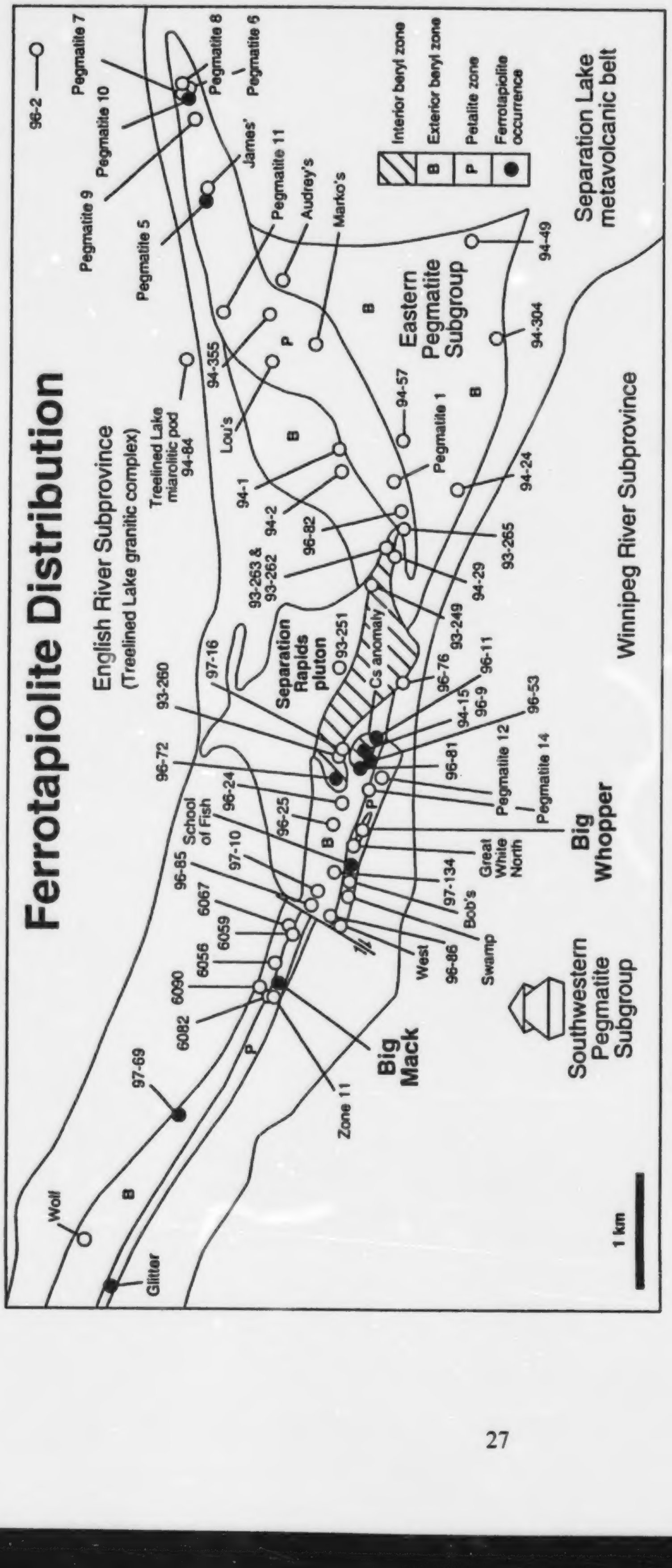
Ferrotapiolite Distribution
English River Subprovince
(Treelined Lake granitic complex)
Treelined Lake miarolitic pod 94-84
Winnipeg River Subprovince
Separation Lake metavolcanic belt
Eastern Pegmatite Subgroup
Southwestern Pegmatite Subgroup
Separation Rapids pluton
Cs anomaly
Big Mack
Big Whopper
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Ferrotapiolite occurrence
1 km
96-2
Pegmatite 7
Pegmatite 8
Pegmatite 6
Pegmatite 10
Pegmatite 9
James'
Pegmatite 11
Audrey's
Marko's
Pegmatite 5
94-49
94-304
94-355
Lou's
94-57
Pegmatite 1
94-1
94-2
94-24
96-82
93-265
93-263 & 93-262
94-29
93-251
93-249
97-16
96-76
96-11
93-260
94-15
96-9
96-53
96-72
96-81
Pegmatite 12
Pegmatite 14
96-24
School of Fish
96-25
96-85
97-10
Great White North
97-134
6067
Bob's
6059
6056
West
96-86
Swamp
6090
6082
97-69
Zone 11
Wolf
Glitter
B
P

**Figure 4.** Ferrotapiolite group distribution map.

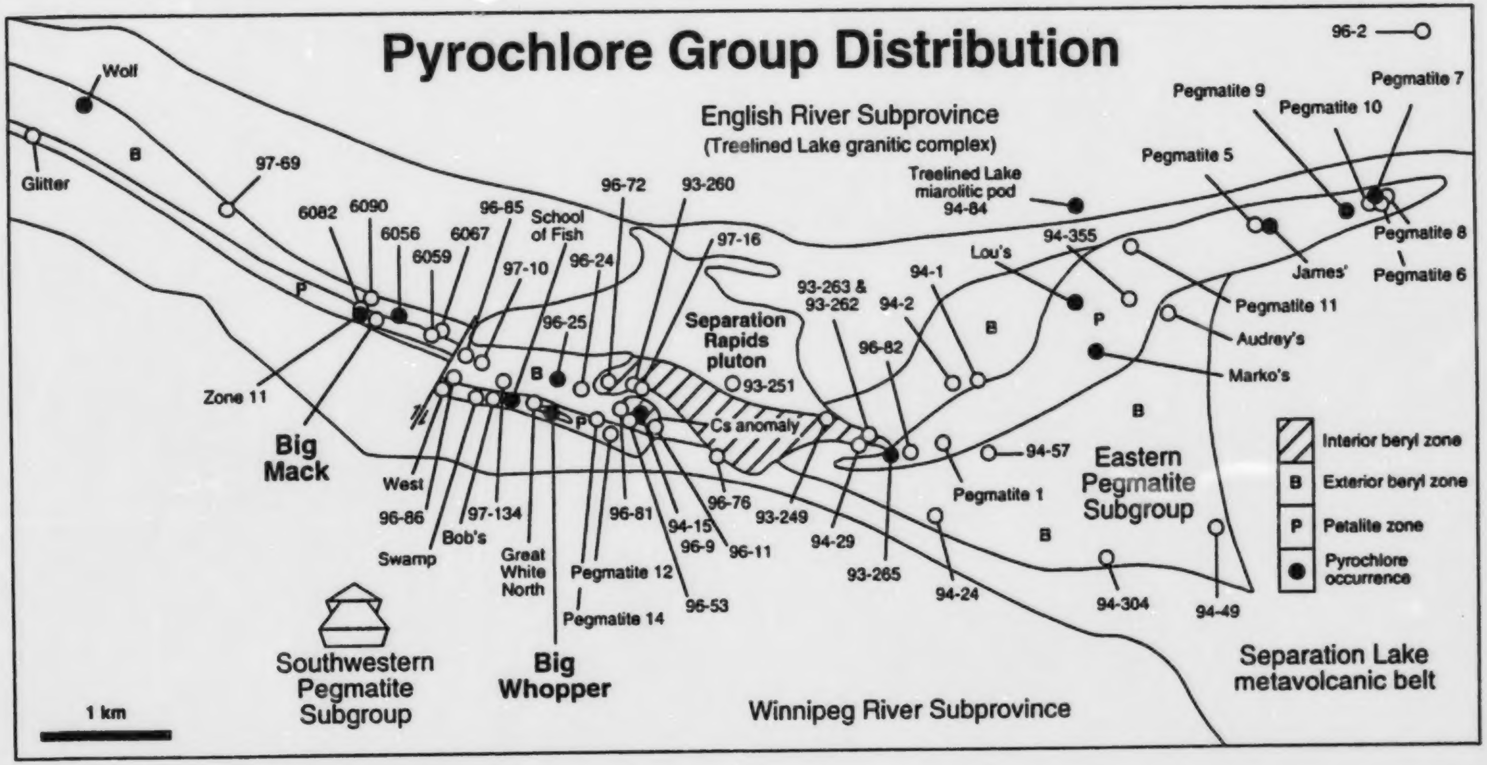
Pyrochlore Group Distribution
English River Subprovince
(Treelined Lake granitic complex)
Winnipeg River Subprovince
Separation Lake metavolcanic belt
Southwestern Pegmatite Subgroup
Eastern Pegmatite Subgroup
Separation Rapids pluton
Cs anomaly
Big Mack
Big Whopper
1 km
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Pyrochlore occurrence
B
P
Wolf
Glitter
97-69
6082
6090
6056
6067
6059
96-85
School of Fish
97-10
96-24
96-25
96-72
93-260
97-16
93-251
Zone 11
West
96-86
Swamp
97-134
Bob's
Great White North
Pegmatite 12
Pegmatite 14
96-81
94-15
96-9
96-11
96-53
96-76
93-249
94-29
93-265
93-263 & 93-262
94-2
94-1
96-82
Lou's
94-355
Treelined Lake miarolitic pod 94-84
Pegmatite 1
94-57
94-24
94-304
94-49
Pegmatite 5
Pegmatite 9
Pegmatite 10
Pegmatite 7
96-2
Pegmatite 8
Pegmatite 6
James'
Pegmatite 11
Audrey's
Marko's

**Figure 5.** Pyrochlore group distribution map.

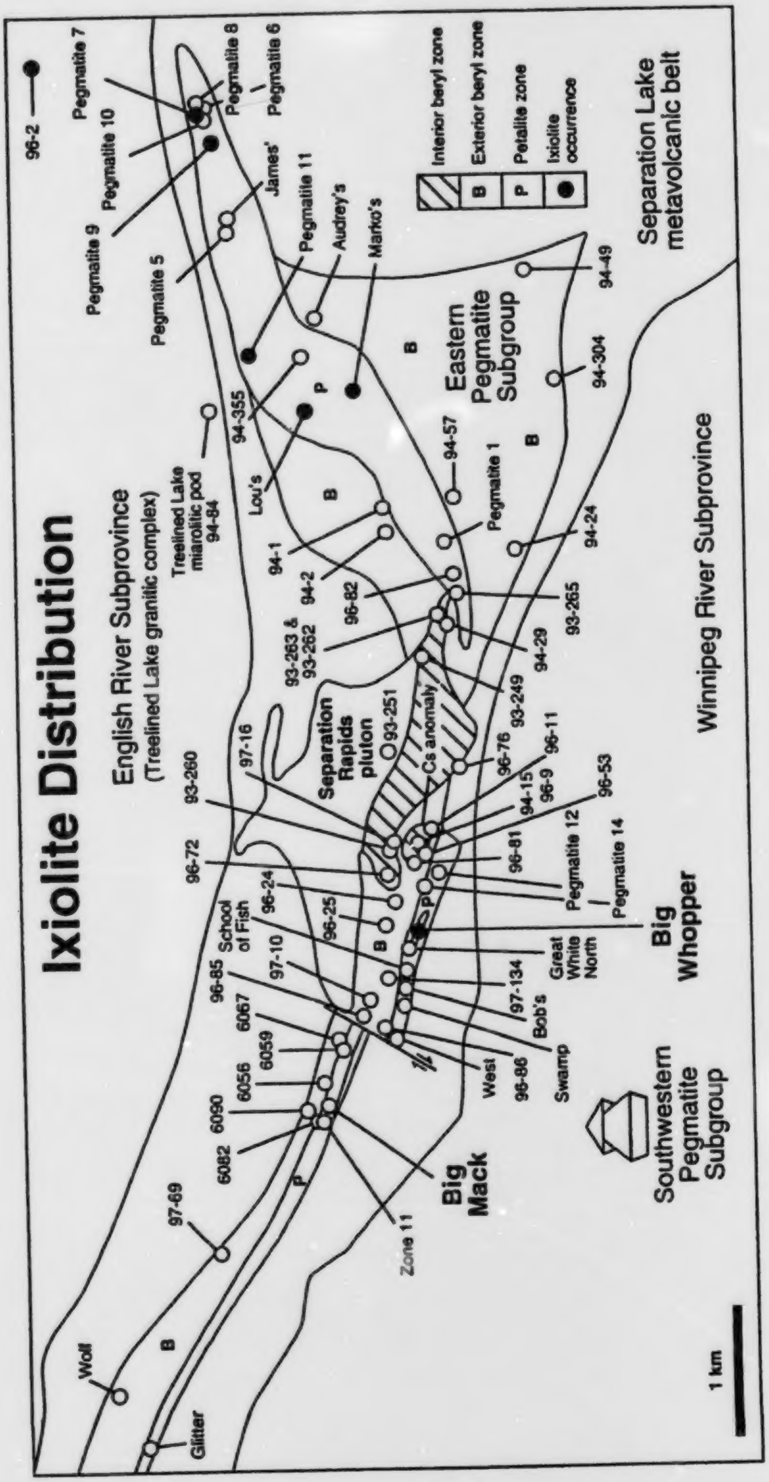
Ixiolite Distribution
English River Subprovince
(Treelined Lake granitic complex)
Winnipeg River Subprovince
Separation Lake metavolcanic belt
Eastern Pegmatite Subgroup
Southwestern Pegmatite Subgroup
Separation Rapids pluton
Cs anomaly
Big Mack
Big Whopper
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Ixiolite occurrence
96-2
Pegmatite 7
Pegmatite 8
Pegmatite 6
Pegmatite 10
Pegmatite 9
Pegmatite 5
James'
Pegmatite 11
Audrey's
Marko's
94-49
94-304
94-355
Treelined Lake miarolitic pod 94-84
Lou's
94-57
Pegmatite 1
94-1
94-2
94-24
96-82
93-265
93-263 & 93-262
94-29
93-249
93-251
97-16
93-260
96-76
96-11
96-9
94-15
96-53
96-81
Pegmatite 12
Pegmatite 14
96-72
96-24
96-25
School of Fish
Great White North
96-85
97-10
97-134
Bob's
6067
6059
6056
6090
6082
West
96-86
Swamp
97-69
Zone 11
Wolf
Glitter
B
P
1 km

**Figure 6.** Ixiolite distribution map.

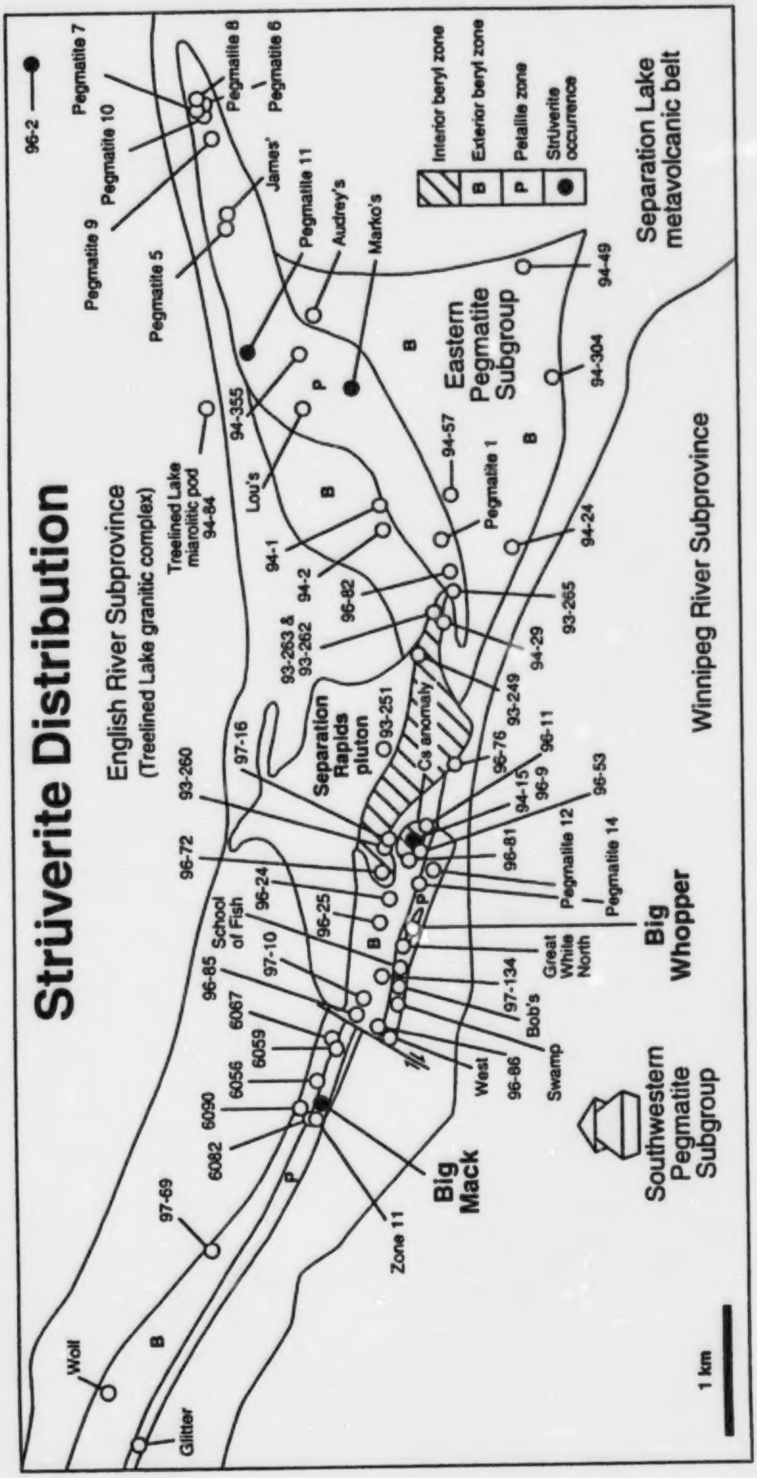
Strüverite Distribution
English River Subprovince
(Treelined Lake granitic complex)
Winnipeg River Subprovince
Separation Lake metavolcanic belt
Eastern Pegmatite Subgroup
Southwestern Pegmatite Subgroup
Separation Rapids pluton
Cs anomaly
Big Mack
Big Whopper
Treelined Lake miarolitic pod 94-84
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Strüverite occurrence
1 km
Wolf
Glitter
97-69
6082
6090
6056
6059
6067
96-85
97-10
School of Fish
96-24
96-25
96-72
93-260
97-16
93-251
93-263 & 93-262
94-1
94-2
96-82
Lou's
94-355
Pegmatite 5
Pegmatite 9
Pegmatite 10
Pegmatite 7
96-2
Pegmatite 8
Pegmatite 6
James'
Pegmatite 11
Audrey's
Marko's
94-57
Pegmatite 1
94-24
94-304
94-49
93-265
94-29
93-249
96-76
96-11
96-9
94-15
96-53
96-81
Pegmatite 12
Pegmatite 14
Great White North
97-134
Bob's
West
96-86
Swamp
Zone 11
B
P

Figure 7. Strüverite distribution map.

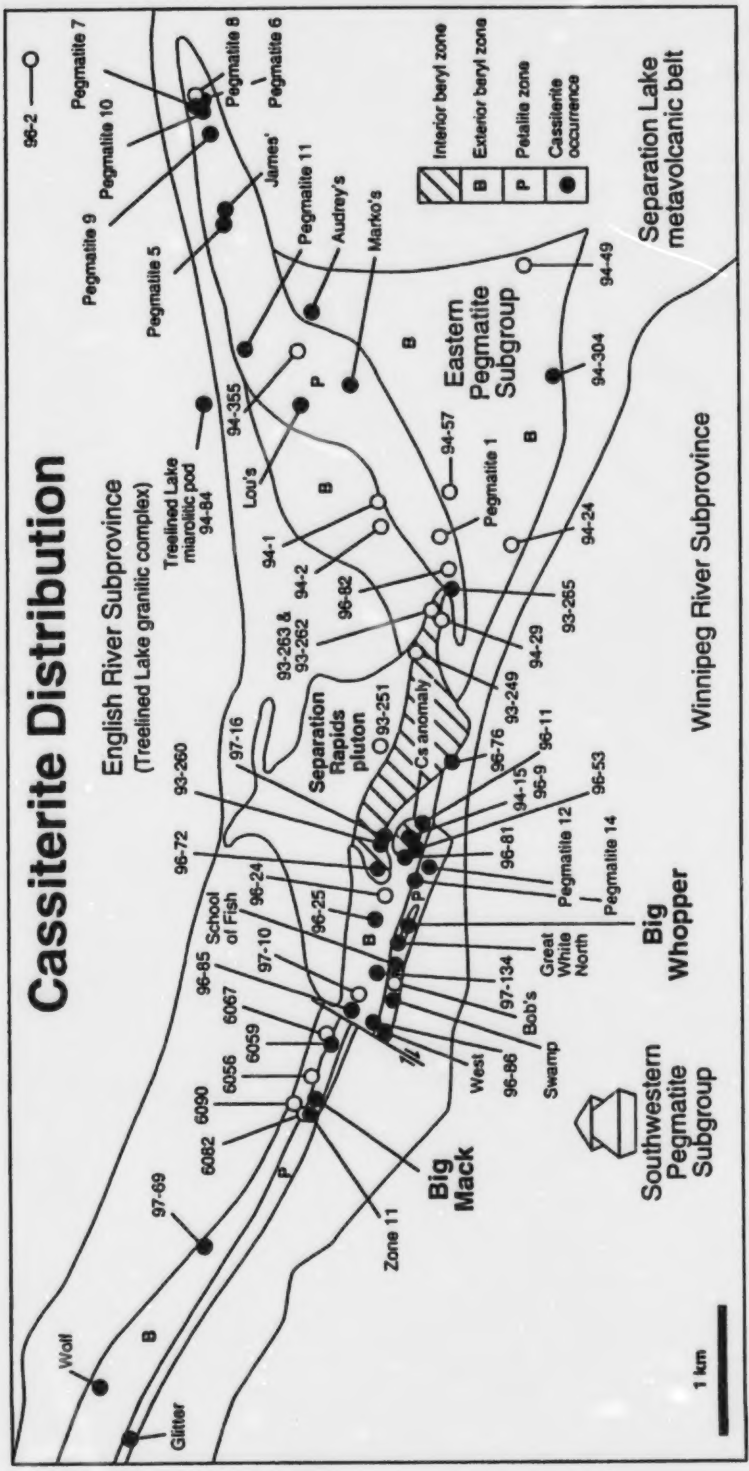
Cassiterite Distribution
English River Subprovince
(Treelined Lake granitic complex)
Winnipeg River Subprovince
Separation Lake metavolcanic belt
Separation Rapids pluton
Eastern Pegmatite Subgroup
Southwestern Pegmatite Subgroup
Big Mack
Big Whopper
Cs anomaly
Interior beryl zone
B Exterior beryl zone
P Petalite zone
● Cassiterite occurrence
1 km
Wolf
Glitter
97-69
Zone 11
6082
6090
6056
6059
6067
96-85
97-10
School of Fish
96-24
96-25
96-72
93-260
97-16
93-251
93-263 & 93-262
96-82
94-2
94-1
Lou's
Treelined Lake miarolitic pod 94-84
94-355
Pegmatite 5
Pegmatite 9
Pegmatite 10
Pegmatite 7
96-2
Pegmatite 8
Pegmatite 6
James'
Pegmatite 11
Audrey's
Marko's
94-57
Pegmatite 1
94-24
93-265
94-29
93-249
96-76
96-11
94-15
96-9
96-53
96-81
Pegmatite 12
Pegmatite 14
Great White North
97-134
Bob's
Swamp
96-86
West
94-304
94-49

Figure 8. Cassiterite distribution map.

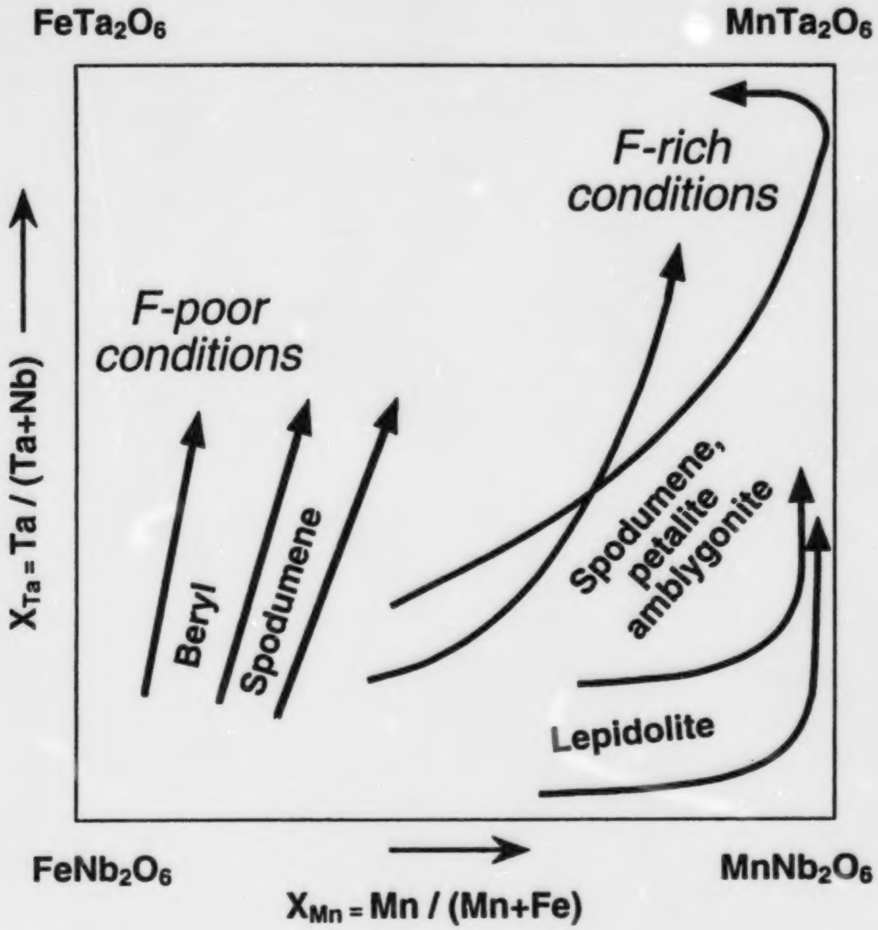
$FeTa_2O_6$
$MnTa_2O_6$
F-rich conditions
F-poor conditions
Beryl
Spodumene
Spodumene, petalite, amblygonite
Lepidolite
$X_{Ta} = Ta / (Ta+Nb)$
$FeNb_2O_6$
$MnNb_2O_6$
$X_{Mn} = Mn / (Mn+Fe)$

**Figure 9.** Columbite-tantalite quadrilateral based on Černý (1989a, 1992). Vectors describe variation trends in beryl-type and complex-type (spodumene-, petalite- amblygonite- and lepidolite-subtype) pegmatites.

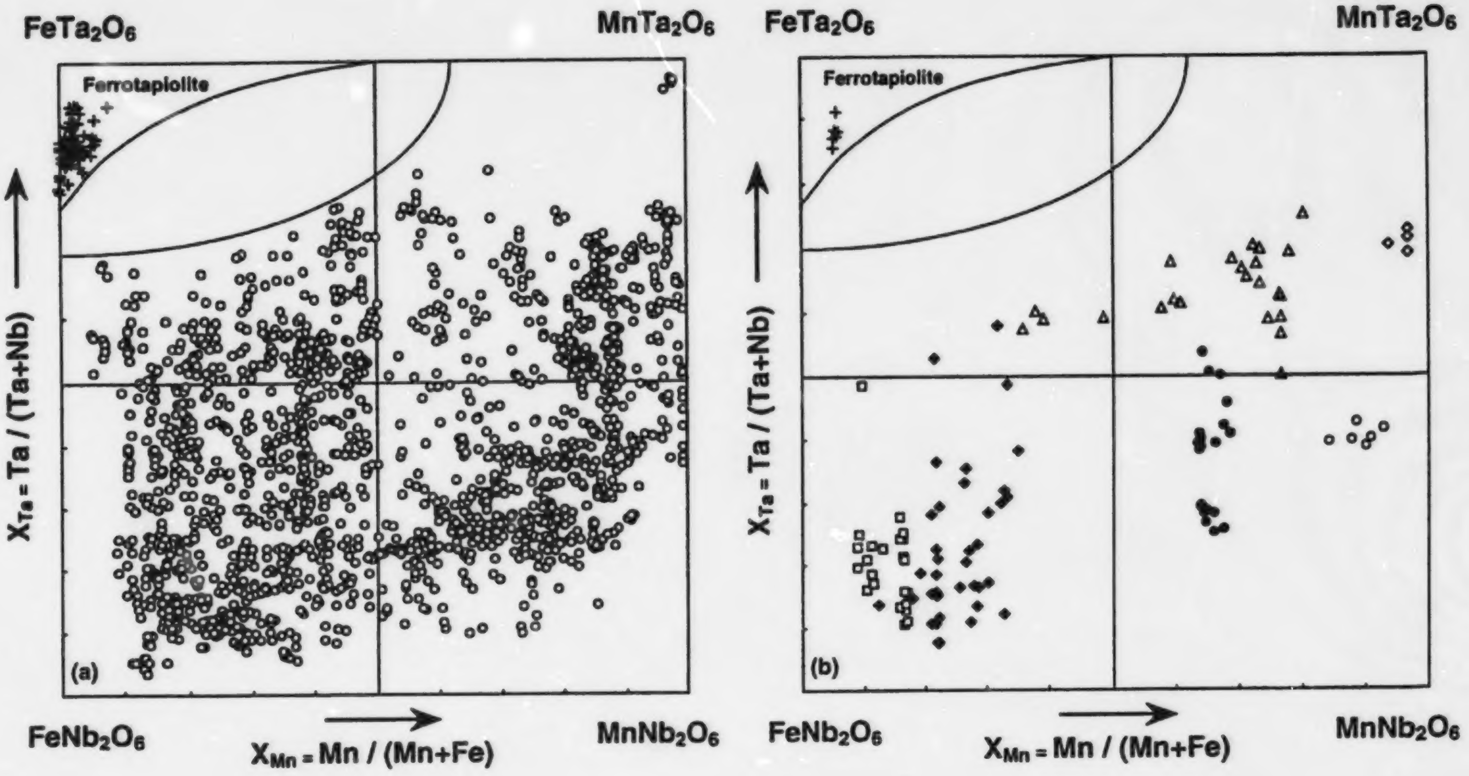

**Figure 10.** Columbite-tantalite quadrilateral. (a) Full Separation Rapids dataset for columbite-tantalite (open circles) and ferrotapiolite (open squares) are shown. (b) Columbite-tantalite from the Separation Rapids pluton and associated Li-mica-cleavelandite pods. Symbols: open squares, primitive pluton compositions; solid diamonds, evolved pluton compositions; open triangles, diamonds and circles, three samples from Li mica-cleavelandite pods at location 93-260; solid circles, Mn columbite-tantalite from a miarolitic cavity in the Treelined Lake Complex. Ferrotapiolite data from the southwestern margin of the Separation Rapids pluton are also plotted (plus symbols).

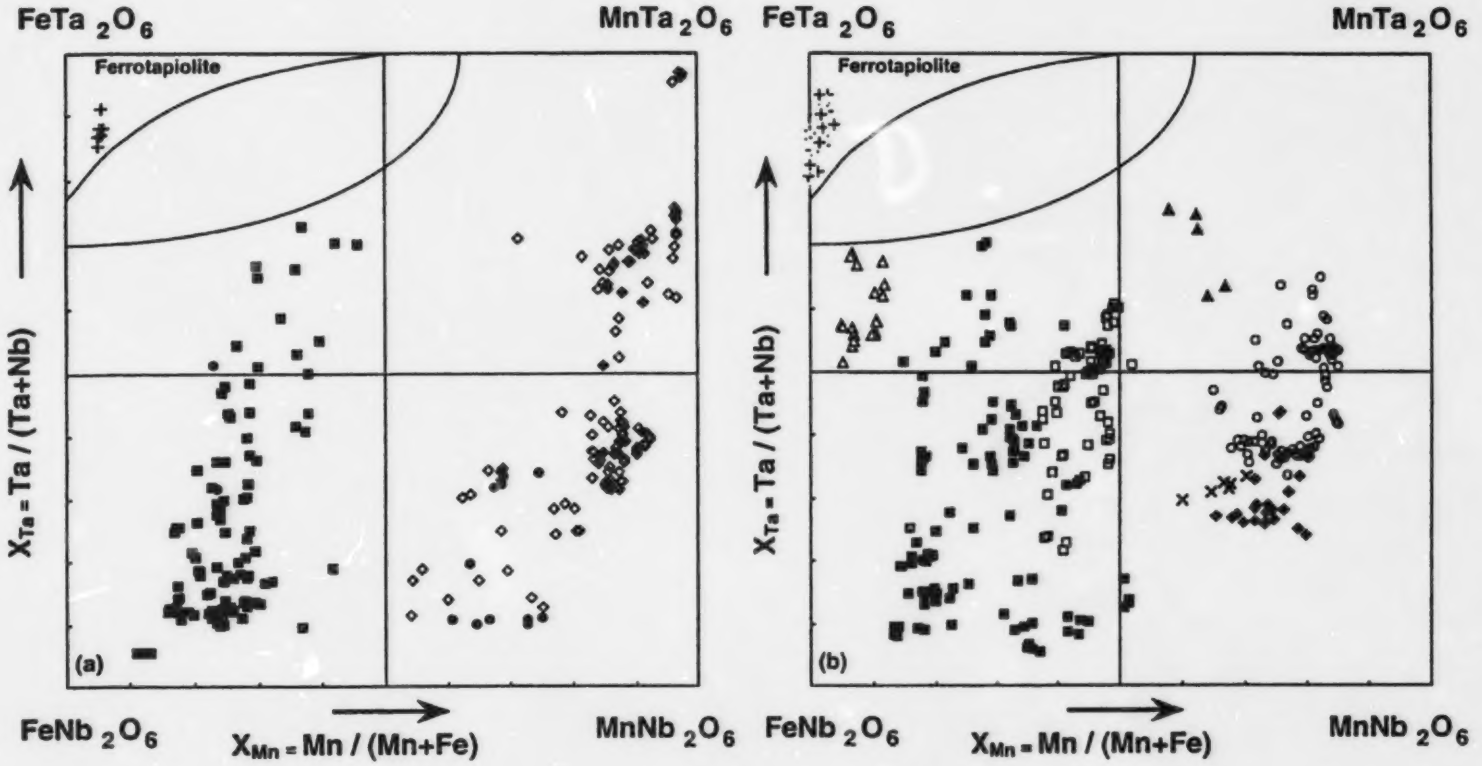

**Figure 11.** Columbite-tantalite quadrilateral. (a) Eastern subgroup beryl pegmatite data. Data for nine Fe-suite pegmatites are grouped together (solid squares). Mn-suite pegmatites 93-263 (solid diamonds), 93-265 (open diamonds) and 94-304 (solid circles) are plotted individually. (b) Southwestern subgroup beryl pegmatite data. Symbols: open triangles, primitive pegmatites associated with ferrotapiolite (96-9 and 96-81); solid squares, main group of Fe-suite pegmatites. Mn-suite pegmatites 97-10A (solid triangles), Wolf pegmatite (solid diamonds), 96-24 (plus symbols), 96-86A (open circles) are plotted individually. The last two samples are from Li mica-cleavelandite pods. Ferrotapiolite data from five Fe-suite pegmatites are also plotted (plus symbols).

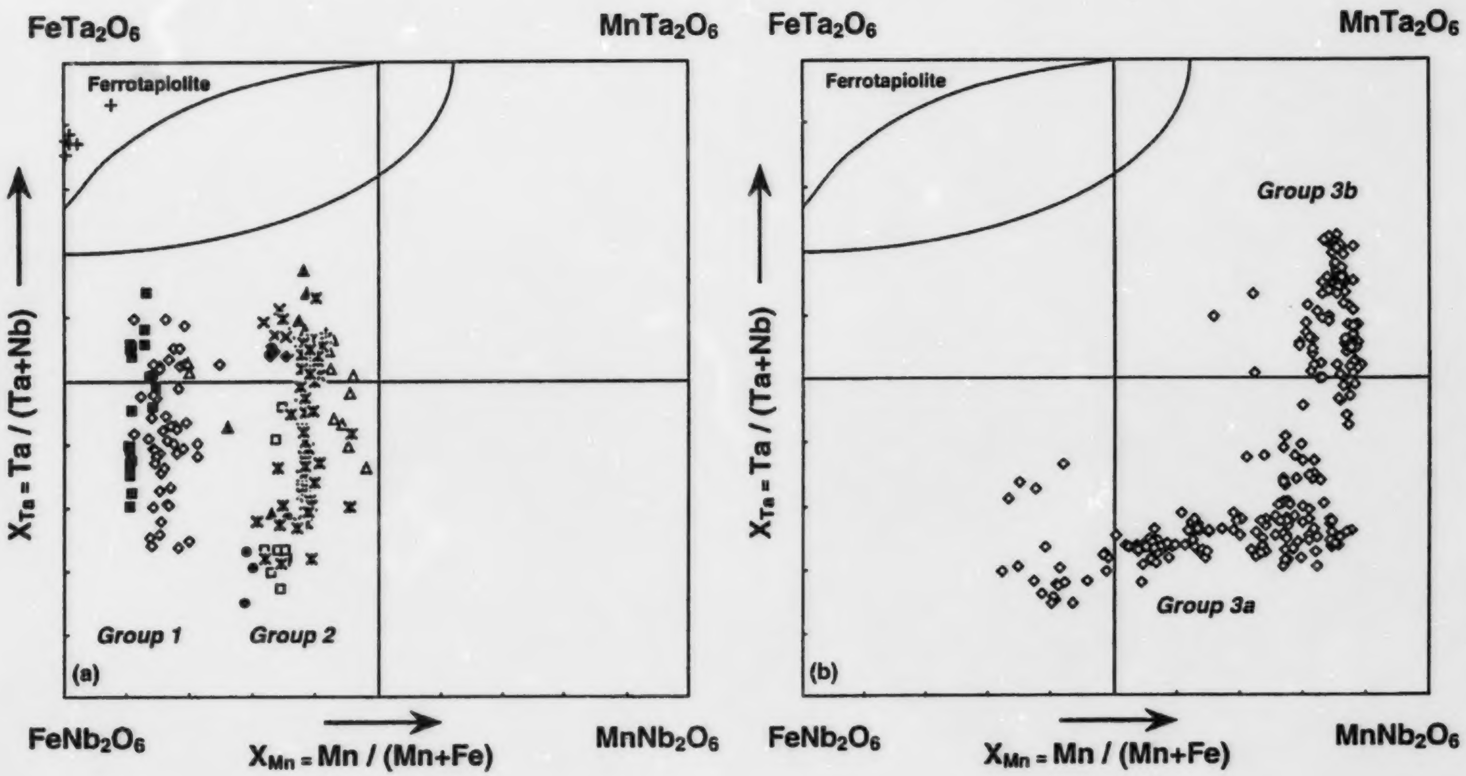

**Figure 12.** Columbite-tantalite quadrilateral. (a) Eastern subgroup Fe-suite petalite pegmatites. Group 1, is represented by Pegmatites 9 (solid squares) and 10 (open diamonds), and Group 2 by Pegmatites 1 (open squares), 5 (solid diamonds), 7 (open triangles), 8 (solid circles), 11 (solid triangles), James' pegmatite (crosses) and Lou's pegmatite (star symbols). Ferrotapiolite data from Pegmatites 5 and 10 are also plotted (plus symbols). (b) Marko's pegmatite, an eastern Mn-suite petalite pegmatite. The outer layered pegmatite-aplite unit is defined by the flat-lying (constant $X_{Ta}$) trend (3a) and the petalite core zone and associated muscovite-albite replacement unit are represented by the vertical (constant $X_{Mn}$) trend (3b).

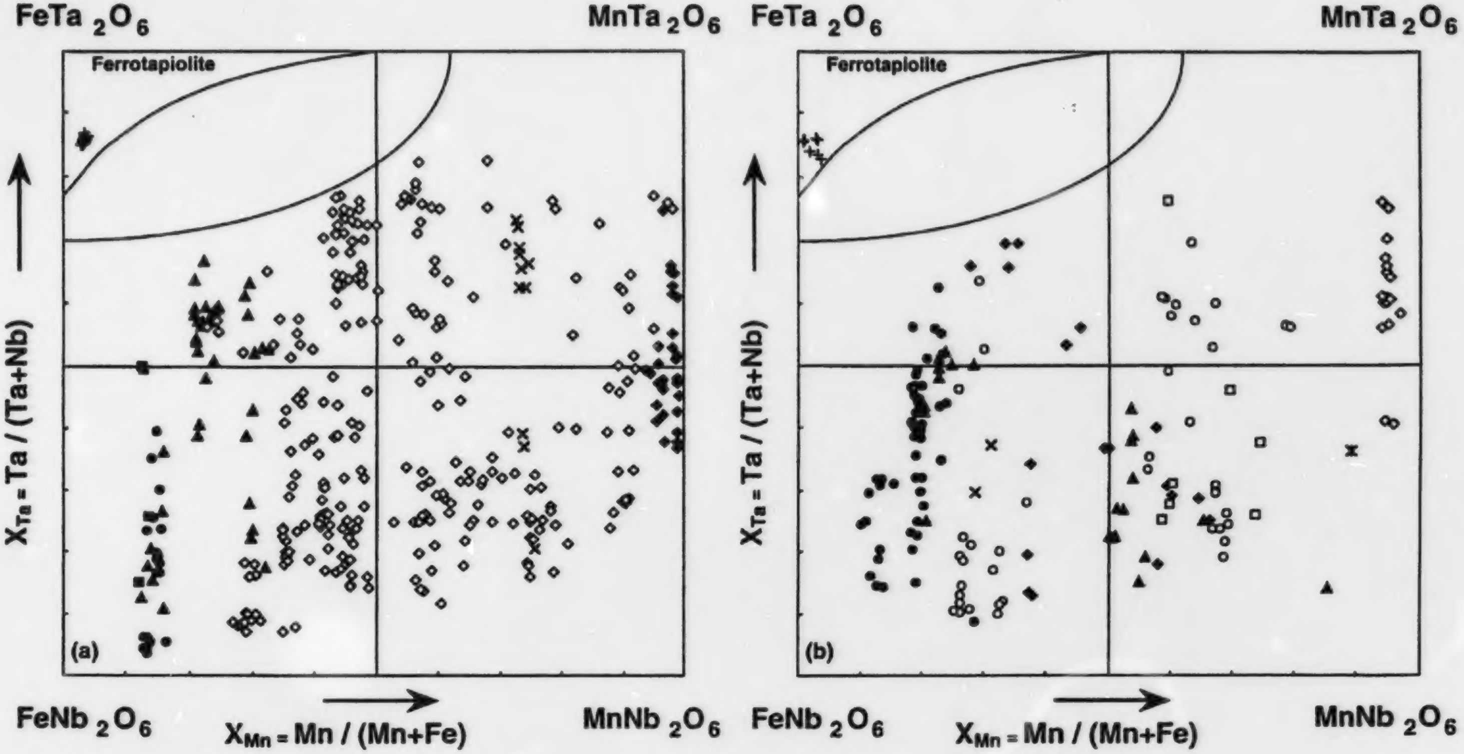

**Figure 13.** Columbite-tantalite quadrilateral. (a) Major SW subgroup petalite pegmatites. Samples from the Big Mack system are represented by the Big Mack pegmatite (solid triangles), Zone 11 pegmatites (solid circles) and the pegmatite from location EFR-6059 (crosses). The Big Whopper pegmatite and its associated lepidolite unit are represented by open and solid diamonds, respectively. The anomalous sample from the Big Whopper (97-BW5) is plotted with a solid square symbol. (b) Other SW subgroup petalite pegmatites include Pegmatite 12 (star symbols), Pegmatite 14 (crosses), Glitter (solid circles), Great White North (open circles), West (solid triangles), School of Fish (solid diamonds), Bob's (open squares), Swamp (open diamonds). The first three and last two pegmatites are exclusively Fe-suite and Mn-suite pegmatites, respectively. Ferrotapiolite data from a School of Fish pegmatite are also plotted (plus symbols).

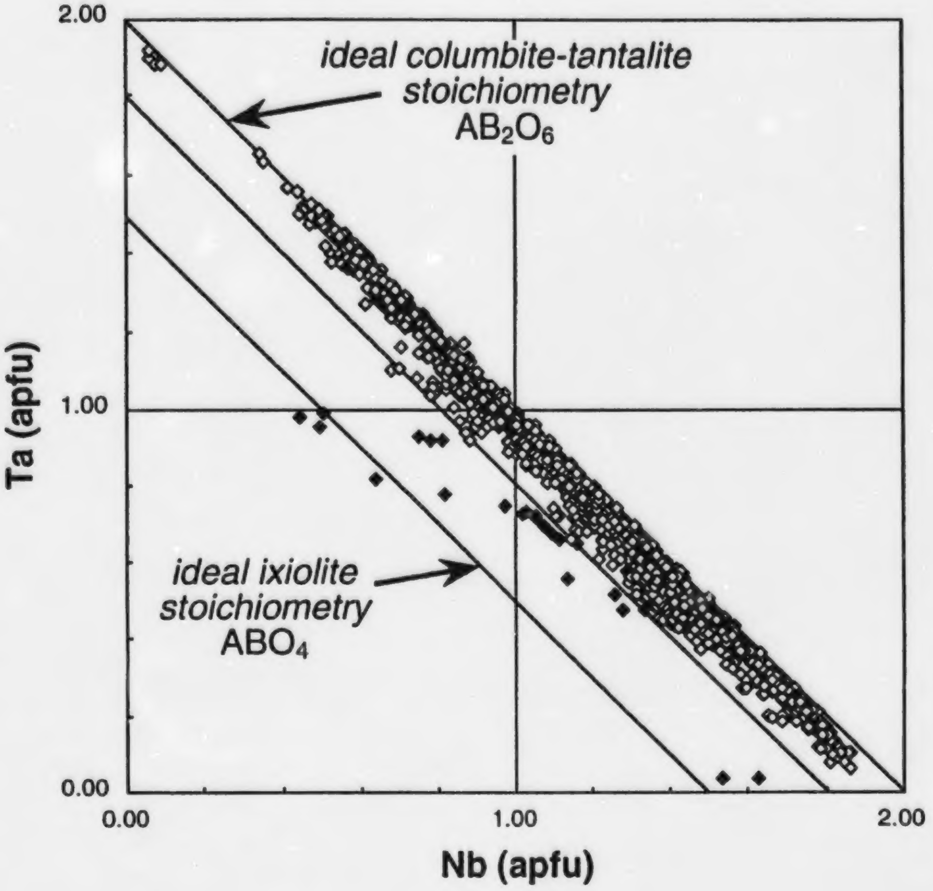

**Figure 14.** Nb versus Ta atoms per formula unit (apfu) for the entire columbite-tantalite and ixiolite dataset. Columbite-tantalite (open diamonds) with ideal $AB_2O_6$ stoichiometry should fall along a tie line between Nb and Ta = 2 atoms per formula unit (apfu), and ixiolite (solid diamonds) with ideal $ABO_4$ stoichiometry, along a tie line between Nb and Ta = 1.5 (apfu). For the Separation Rapids pegmatites, a dividing line between the two has been defined at Nb and Ta = 1.8 (apfu), a similar position as that defined by Neiva (1996).

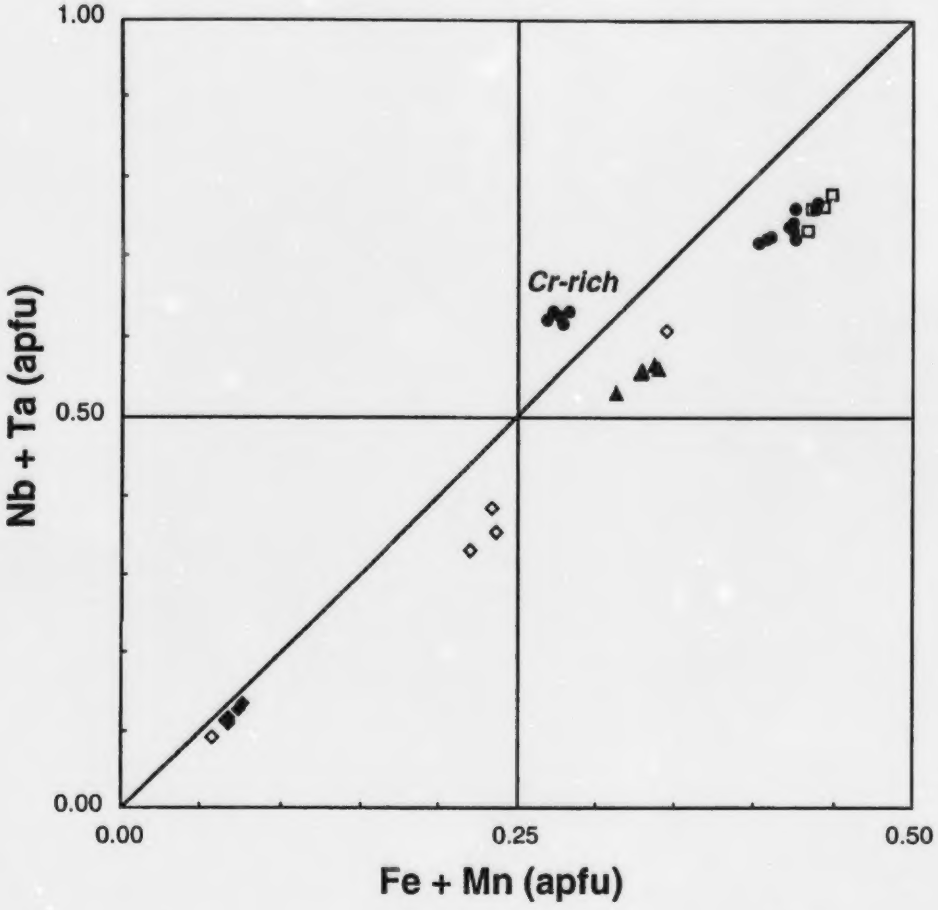

**Figure 15.** Fe+Mn versus Nb+Ta (apfu) for the strüverite dataset. Symbols: solid diamonds, Treelined Lake Complex; open squares, SW subgroup beryl pegmatite 96-9; solid triangles, Pegmatite 11; open diamonds, Marko's pegmatite; and solid circles, Big Mack pegmatite. Data approaching the origin of the graph are, in fact, ilmenorutile.

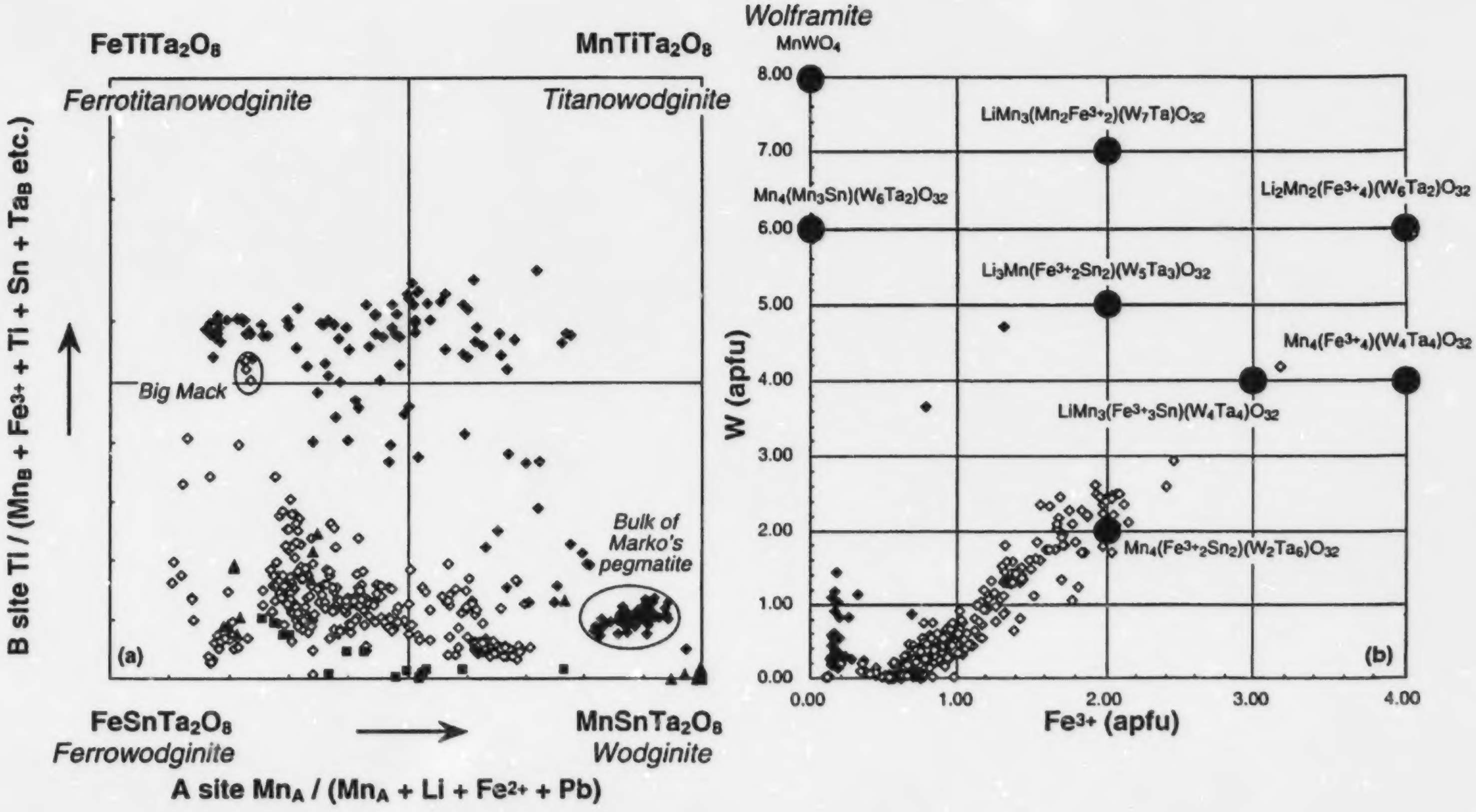

**Figure 16.** (a) Wodginite quadrilateral for the entire Separation Lake dataset. The data is divided into Separation Rapids pluton (solid squares), all beryl pegmatites (solid triangles), all petalite pegmatites, excluding Marko's (open diamonds) and Marko's pegmatite (solid diamonds). (b) Fe$^{3+}$ versus W (apfu) for most of the Separation Rapids wodginite group dataset, illustrating good correlation of these elements. Beryl pegmatite from location 93-265 is plotted separately (solid diamonds). For clarity, data Marko's pegmatite is not plotted.

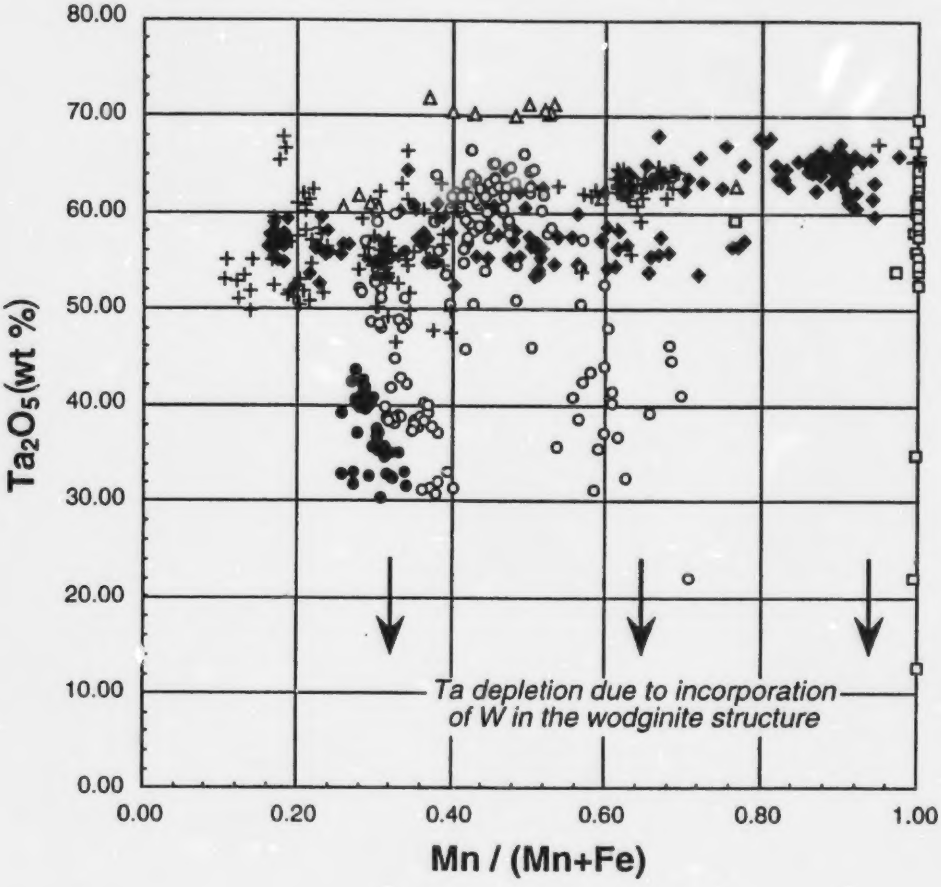

**Figure 17.** Mn/(Mn+Fe) versus $Ta_2O_5$ wt % for all wodginite group data from the Separation Rapids pluton and pegmatites. Much of the data (solid squares, pluton; solid diamonds, Marko's pegmatite; open diamonds, most beryl and petalite pegmatites) follow a general trend from 50 wt % toward 70 wt % $Ta_2O_5$ apart from those samples where W substitution for Ta has occurred; e.g., Pegmatite 5 (plus symbols), Pegmatite 6 (crosses) and at location 93-265 (solid triangles).

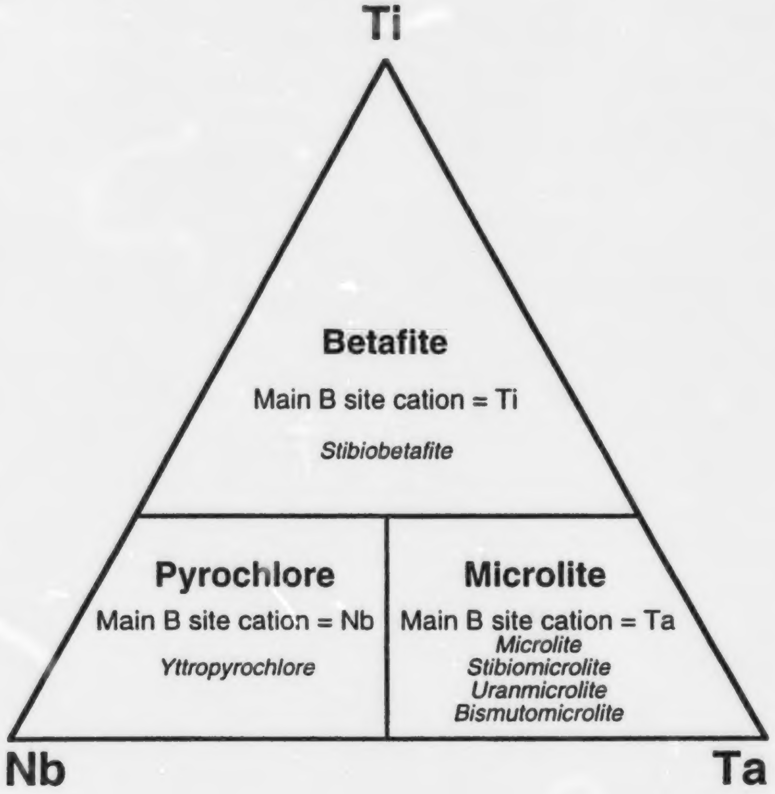
Ti
Betafite
Main B site cation = Ti
Stibiobetafite
Pyrochlore
Main B site cation = Nb
Yttropyrochlore
Microlite
Main B site cation = Ta
Microlite
Stibiomicrolite
Uranmicrolite
Bismutomicrolite
Nb
Ta

**Figure 18.** The three main subgroups (betafite, pyrochlore and microlite) of the pyrochlore group according to the classification scheme of Hogarth (1977). Names in italics are those species found in the Separation Lake area.

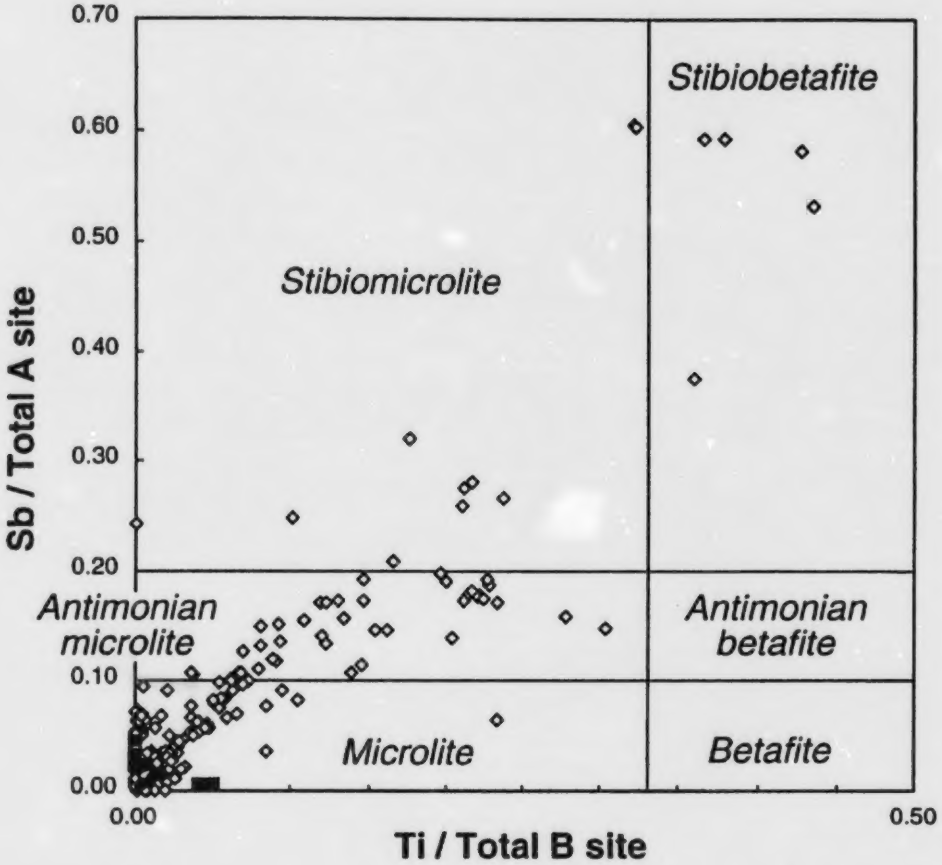

**Figure 19.** Ti/total B site versus Sb/total A site for pyrochlore group minerals from the Treelined Lake complex and Separation Rapids pegmatites.

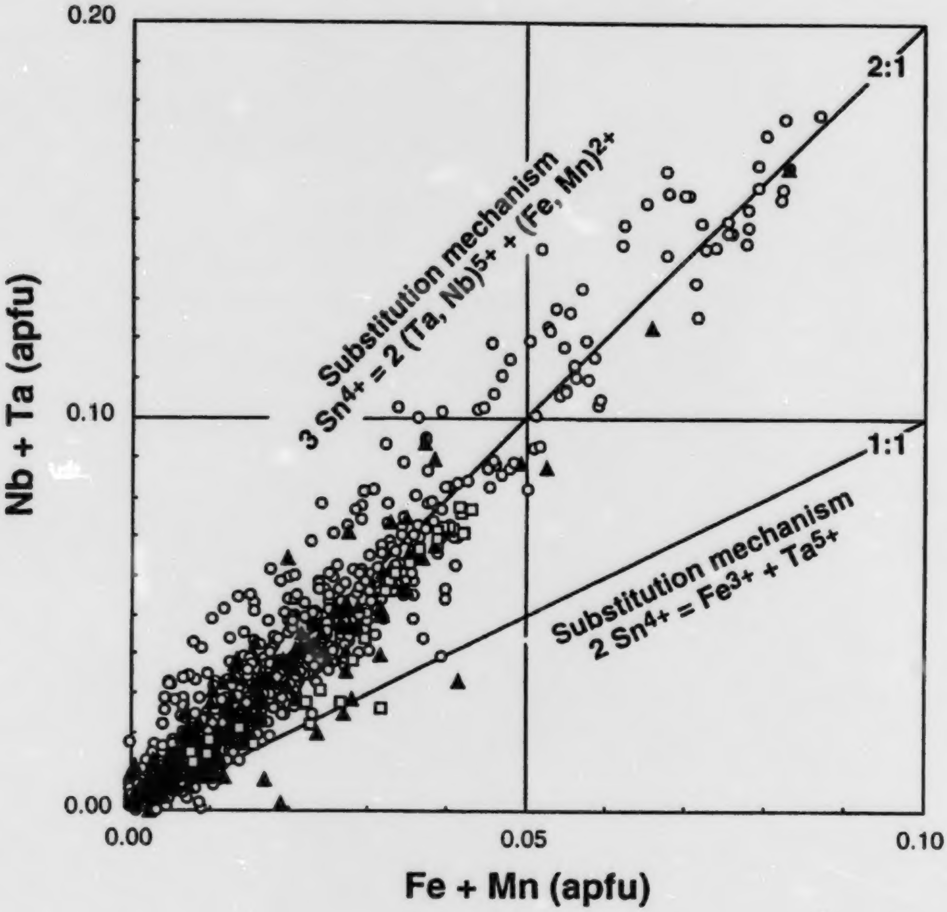

**Figure 20.** Fe+Mn versus Nb+Ta (apfu) for all cassiterite data from the Separation Lake area. Symbols: open diamonds, Treelined Lake Complex; open squares, Separation Rapids pluton; solid triangles, beryl pegmatites; open circles, petalite pegmatites. The bulk of the data fall along a linear array with Nb+Ta and Fe+Mn predominantly varying in the ratio of 2:1 corresponding to the coupled substitution: 3 $Sn^{4+}$ ↔ $2(Nb,Ta)^{5+} + (Fe,Mn)^{2+}$. Additionally, cassiterite compositions approaching the 1:1 substitution line on suggest a $Fe^{3+}(Nb,Ta)O_4$ component in a few of the cassiterite analyses, consistent with the substitution: $2Sn^{4+} \leftrightarrow Fe^{3+} + Ta^{5+}$ (Černý and Ercit 1989).

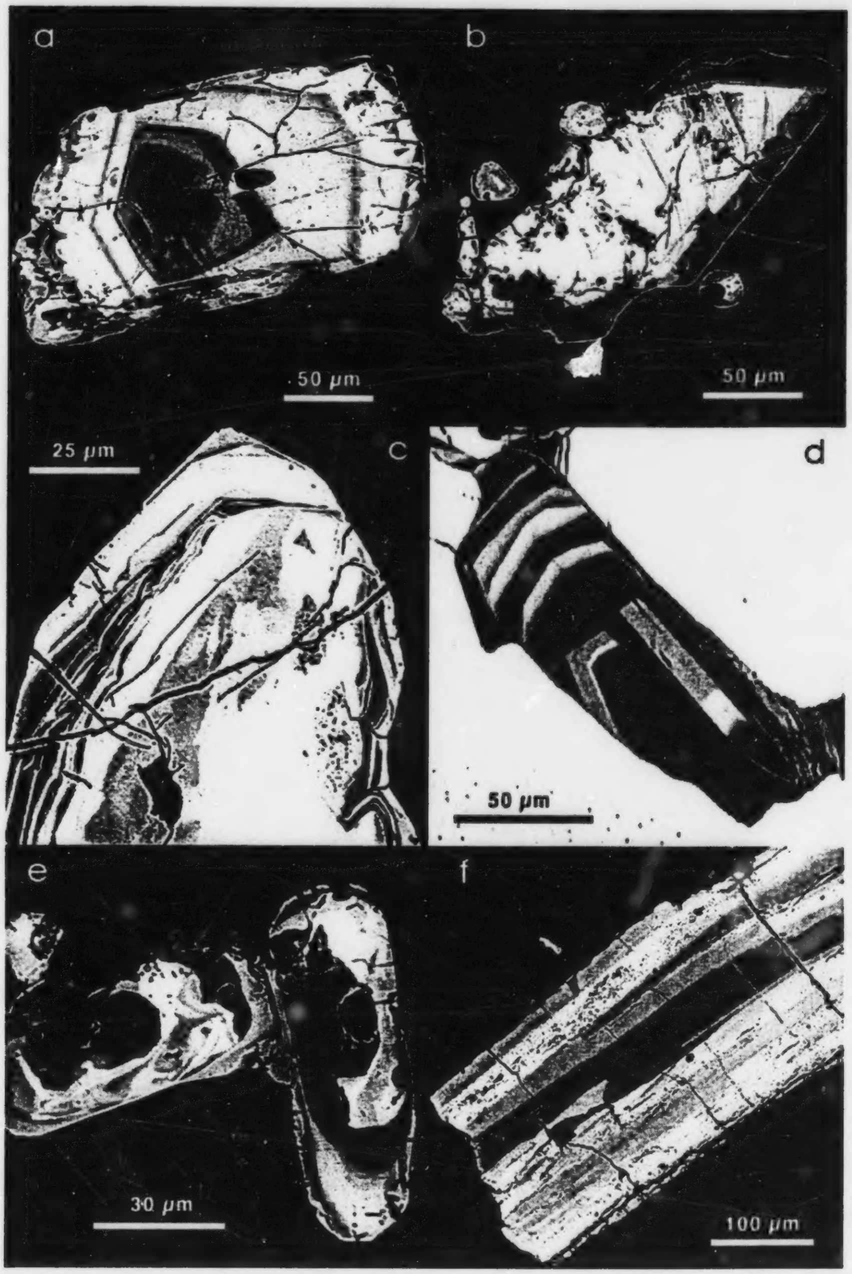

**Photo 1.** Backscattered electron images of columbite-tantalite exhibiting primary zonation. (a) Oscillatory zoned grain (manganocolumbite core to manganotantalite rim). Mn-suite eastern subgroup beryl pegmatite; 93-263. (b) Oscillatory zoned grain where niobium-rich rim truncates earlier, strongly zoned part of grain (manganotantalite core to manganocolumbite rim). Mn-suite eastern subgroup beryl pegmatite; 93-263. (c) Euhedral oscillatory zoned (mainly) ferrocolumbite exhibiting irregular and discontinuous zones indicating many episodes of dissolution that have led to truncated layers and angular unconformities. Fe-suite eastern subgroup petalite pegmatite; Lou's, 93-272B. (d) Oscillatory zoned ferrocolumbite inclusion in cassiterite. Fe-suite SW subgroup petalite pegmatite; Zone 11 (Big Mack system), 99-ATZ11. (e) Oscillatory zoned subhedral crystals with ferrocolumbite cores and ferrotantalite margins. Note the rounded corners, embayments and general discontinuity of the zonation. SW subgroup petalite pegmatite; Big Whopper, 97-186A. (f) Manganocolumbite core to manganotantalite rim. Tantalum-rich zones are porous and end of crystal has been broken away. Miarolitic cavity in Treelined Lake Complex; 94-84A. In this and all other figures of this type (a) top left, (b) top right, (c) middle left, (d) middle right, (e) bottom left, (f) bottom right.

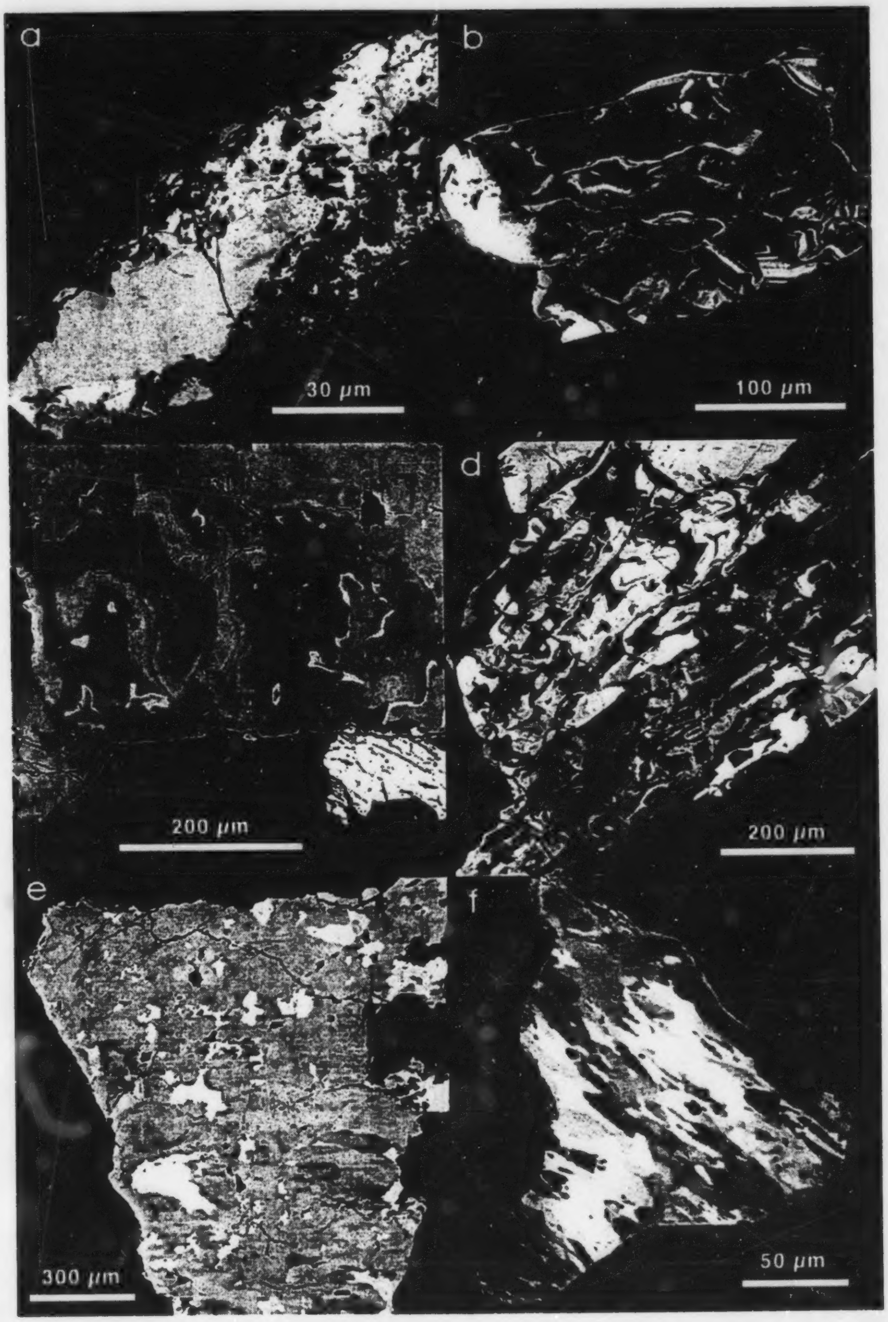

**Photo 2.** Backscattered electron images of columbite-tantalite exhibiting secondary zonation. (a) Unzoned manganotantalite (bottom left) partially replaced with patchy zoned (mainly) ferrocolumbite (dark regions, top right) and minor microlite (bright regions, top right). Apatite-Li mica-cleavelandite pod in SW subgroup beryl pegmatite; 96-86A. (b) Patchy zoned ferrocolumbite with marginal ferrotantalite (white region on left). Fe-suite eastern subgroup petalite pegmatite; Lou's, 93-272B. (c) Ferrocolumbite with particularly well-developed patchy zonation at the margin of the crystal. White grain is microlite. Fe-suite Separation Rapids pluton; 94-29. (d) Patchy zoned crystal with variable ferrocolumbite (dark) and manganocolumbite (light) composition. Inclusion in Li mica from wall-zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44Mu5(2). (e) Patchy zoned ferrocolumbite with microlite inclusions. Wall-zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 96-AT7. (f) Patchy zoned ferrocolumbite (with some of the brighter regions reaching ferrotantalite composition). SW subgroup petalite pegmatite; Big Mack, 98-83E.

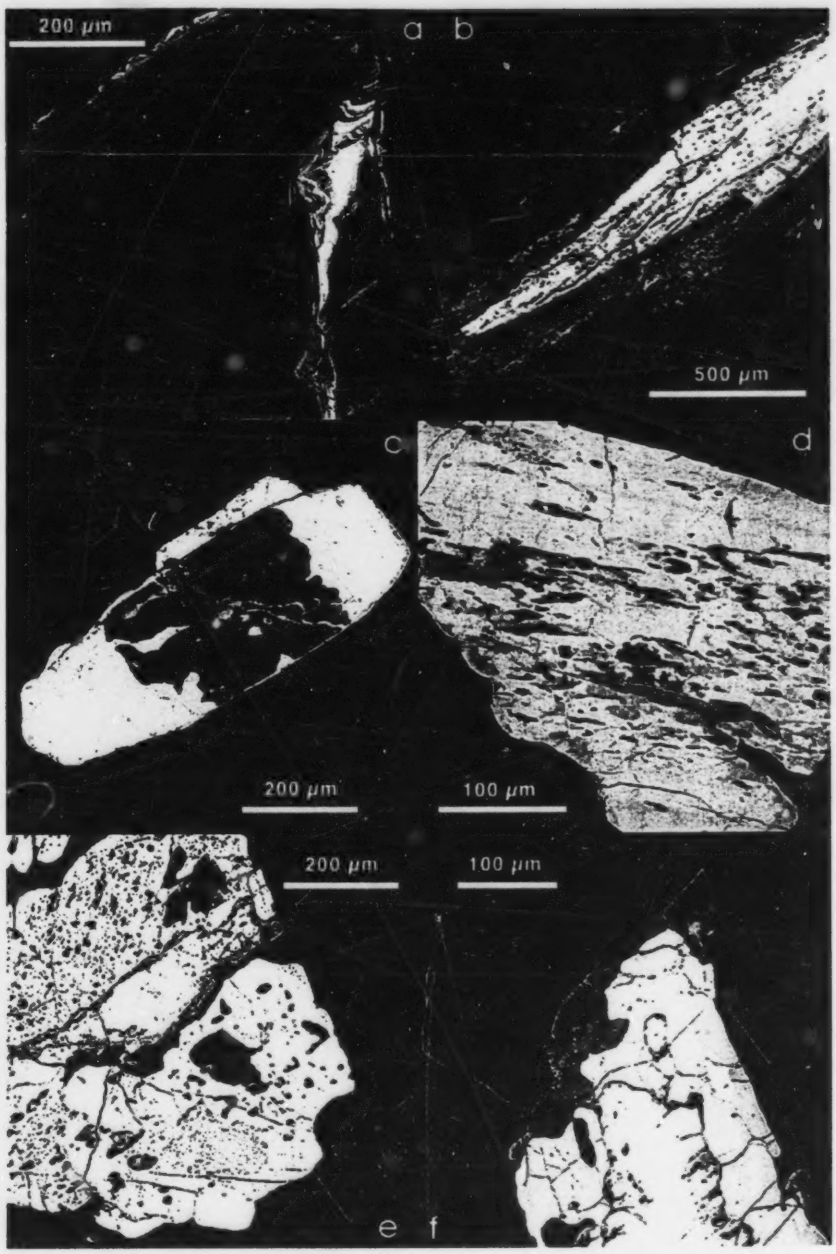

**Photo 3.** Backscattered electron images of columbite-tantalite exhibiting complex features. (a) Manganocolumbite with poorly defined oscillatory zonation disturbed by later patchy zonation towards the margins. The right hand margin of the crystal shows a second phase of unusually regular, oscillatory zoned manganocolumbite. Li mica-cleavelandite pod in Mn-suite eastern subgroup beryl pegmatite; 93-265J. (b) Reversely zoned, bladed crystal of ferrotantalite (core) with ferrocolumbite rim. Secondary, oscillatory growth of tantalum-poor ferrocolumbite occurs at top. Fe-suite eastern subgroup beryl pegmatite; 93-262B. (c) Patchy zoned manganocolumbite with overgrowth of unzoned manganotantalite. Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44E2. (d) Patchy zoned manganotantalite-ferrotantalite, unusual in showing variation in Mn/Fe rather than the more normal Ta/Nb. SW subgroup petalite pegmatite; Big Whopper, 96-29B. (e) Manganotantalite with thin manganocolumbite (alteration) rim included in microlite. The microlite also contains exsolved blebs of columbite-tantalite (possibly ixiolite), some with a myrmekitic texture. Euhedral cassiterite is attached to the microlite (bottom right). Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44E2. (f) Manganotantalite (core) mantled by microlite. The microlite partially includes a patchy zoned, tantalum-poor manganotantalite grain (top left) and attached are two euhedral crystals of cassiterite. The white inclusion in the microlite is wodginite. Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44E2.

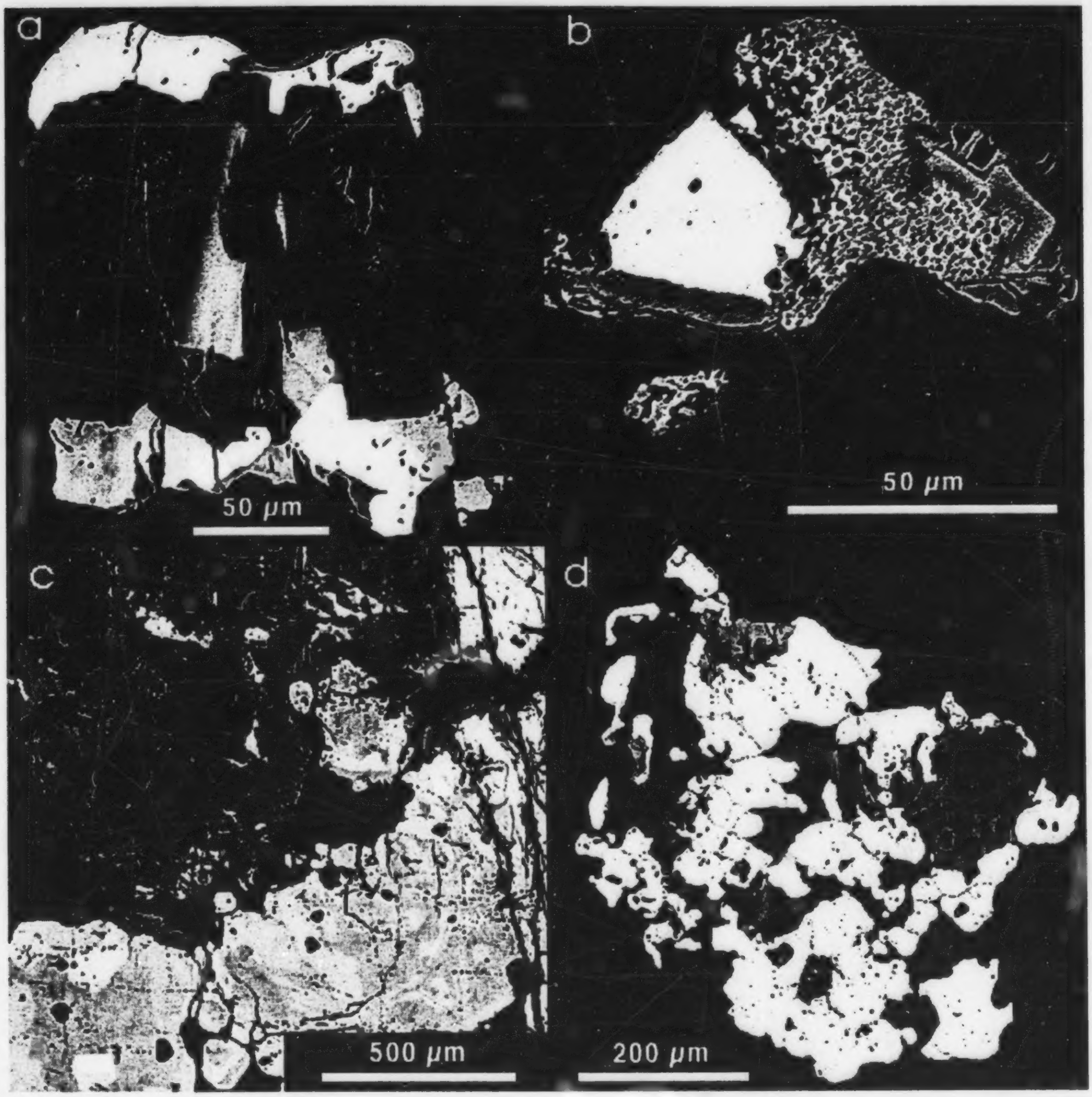

**Photo 4.** Backscattered electron images of ferrotapiolite and associated minerals. (a) Ferrotapiolite rims on vaguely zoned ferrotantalite. SW subgroup beryl pegmatite; 96-9. (b) Unzoned ferrotapiolite (white) partially mantled with porous ferrotantalite, both enclosed in cassiterite. SW subgroup beryl pegmatite; 96-53. (c) Co-existing patchy zoned ferrotapiolite (light) and ferrowodginite. Separation Rapids pluton; 96-72A. (d) Cluster of patchy zoned ferrotantalite (dark), partially mantled by ferrotapiolite. SW subgroup beryl pegmatite; 96-81.

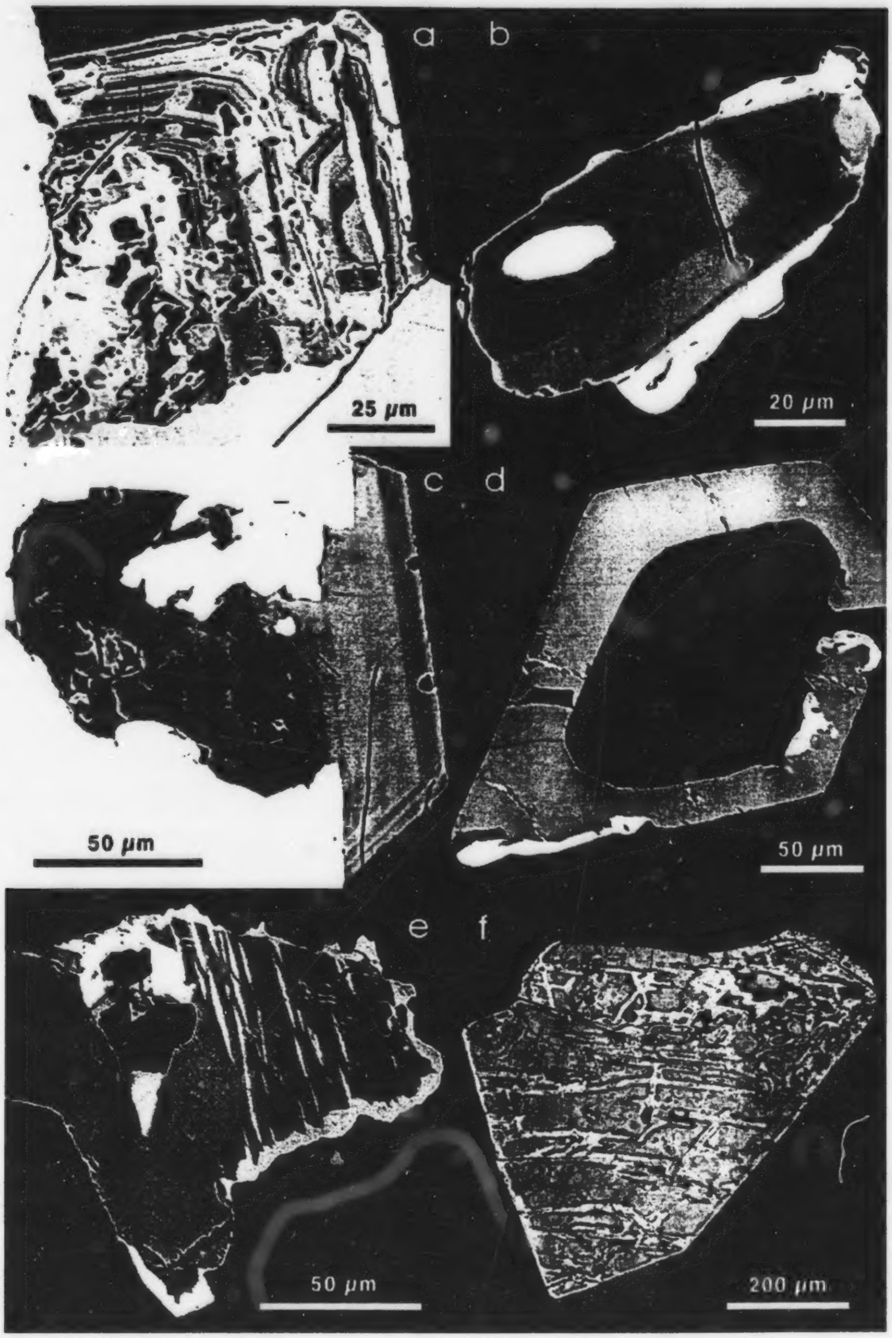

**Photo 5.** Backscattered electron images of ixiolite, strüverite and microlite-ferrotapiolite. (a) Oscillatory zoned ixiolite (enriched in titanium and scandium) in cassiterite. Fe-suite eastern subgroup petalite pegmatite; Lou's, 93-272B. Tungsten-rich ixiolite rim on ferrocolumbite, with ferrotantalite core (white spot). Fe-suite eastern subgroup petalite pegmatite; Pegmatite 9, 94-318. (c) Dark, patchy zoned strüverite with euhedral, oscillatory zoned overgrowth replacing ferrotitanowodginite (white irregular area) and partially enclosed in cassiterite (larger white area); Marko's pegmatite, 94-44J. (d) Euhedral, skeletal crystal of strüverite marginal replaced with ferrowodginite. SW subgroup petalite pegmatite; Big Mack, 98-83C. (e) Strüverite with marginal and ribbon-like replacement by ferrowodginite. SW subgroup petalite pegmatite; Big Mack, 98-83C. (f) Euhedral "microlite-ferrotapiolite" composition, partially replaced along cleavage with "microlite". Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44Z.

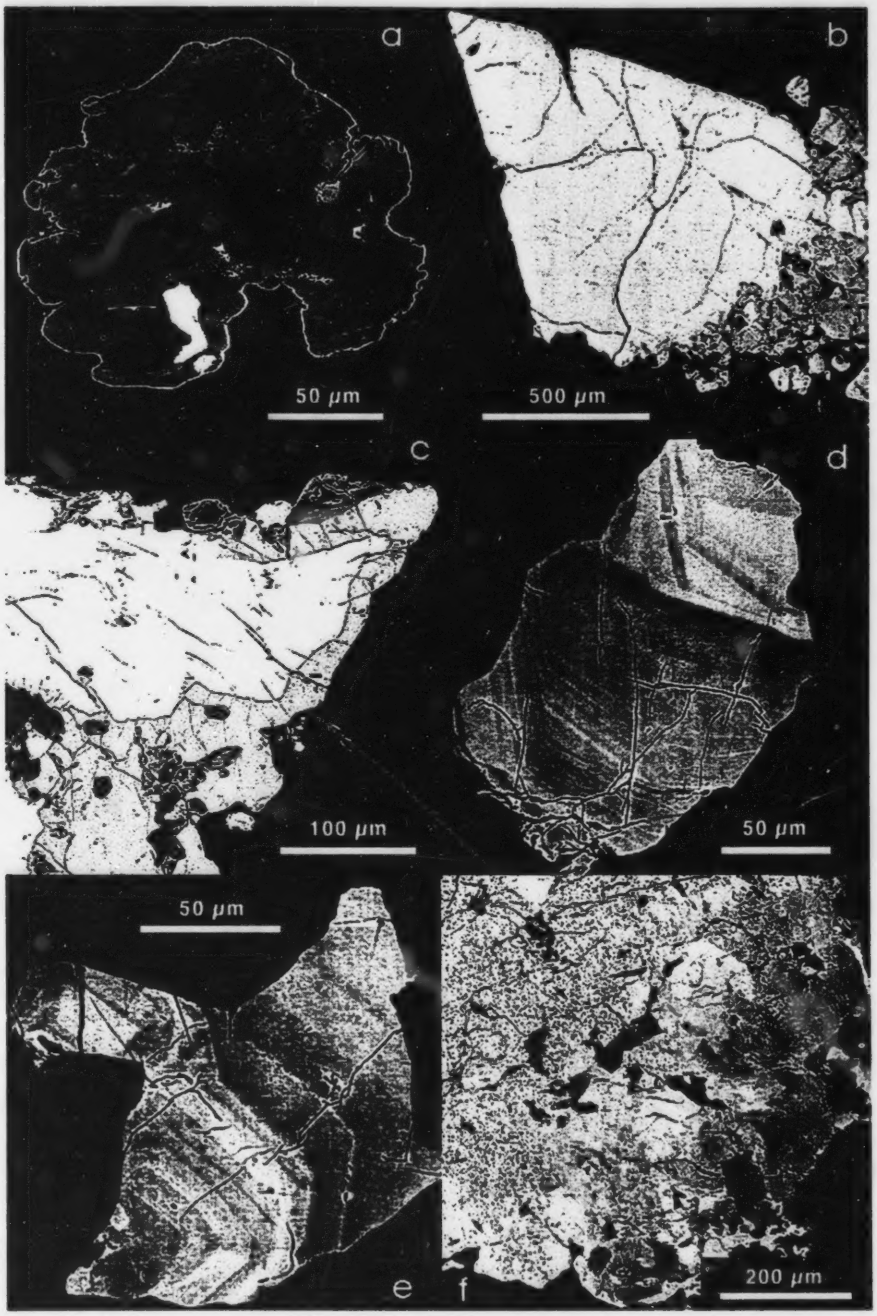

**Photo 6.** Backscattered electron images of wodginite group minerals. (a) Patchy zoned ferrowodginite. Fe-suite eastern subgroup petalite pegmatite; James', 93-276B. (b) Euhedral wodginite, replaced at one end by microlite. Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44D. (c) Wodginite core (white) mantled by microlite which partially encloses a euhedral cassiterite crystal (bottom right). Medium grey patches are columbite-tantalite. Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44R. (d) Oscillatory zoned titanowodginite inclusion in cassiterite. Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44J. (e) Patchy zoned grain with wodginite core (off to top left) to ferrotitanowodginite rim. Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44I. (f) Oscillatory zoned grain from ferrotitanowodginite core to titanowodginite rim. Inclusion in cassiterite. Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44J.

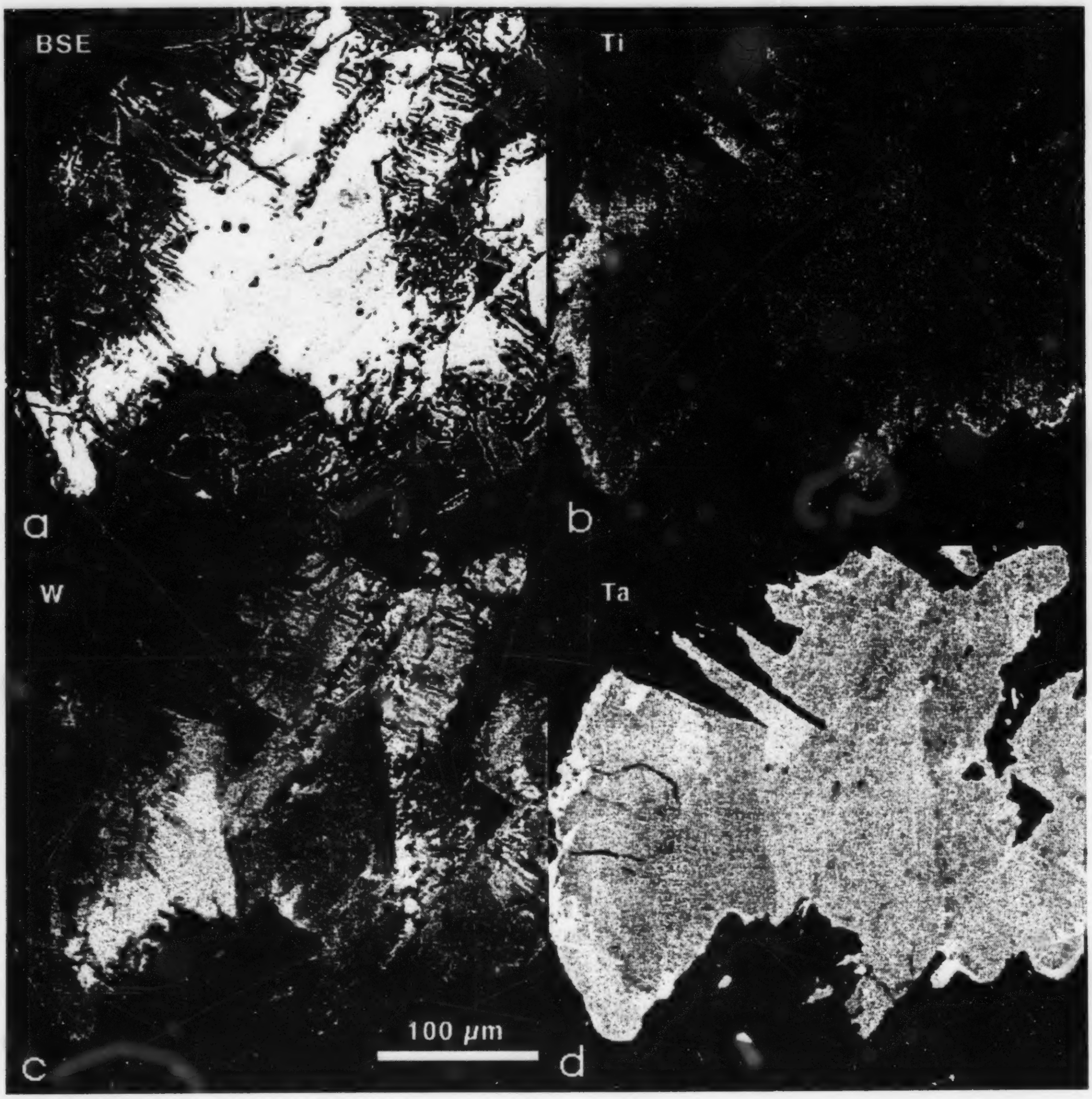

**Photo 7.** Backscattered electron and X-ray images of wodginite group minerals. (a) to (d) Ferrowodginite - tungsteniferous wodginite inclusion in cassiterite showing distinct regions with differing tungsten concentrations. Fe-suite eastern subgroup petalite pegmatite; Pegmatite 5, 94-80E. Tungsten concentration in parts of this grain is sufficiently high to warrant description as a potentially new wodginite species, tentatively referred to as "wolframowodginite 1" by Tindle, Breaks and Webb (1998).

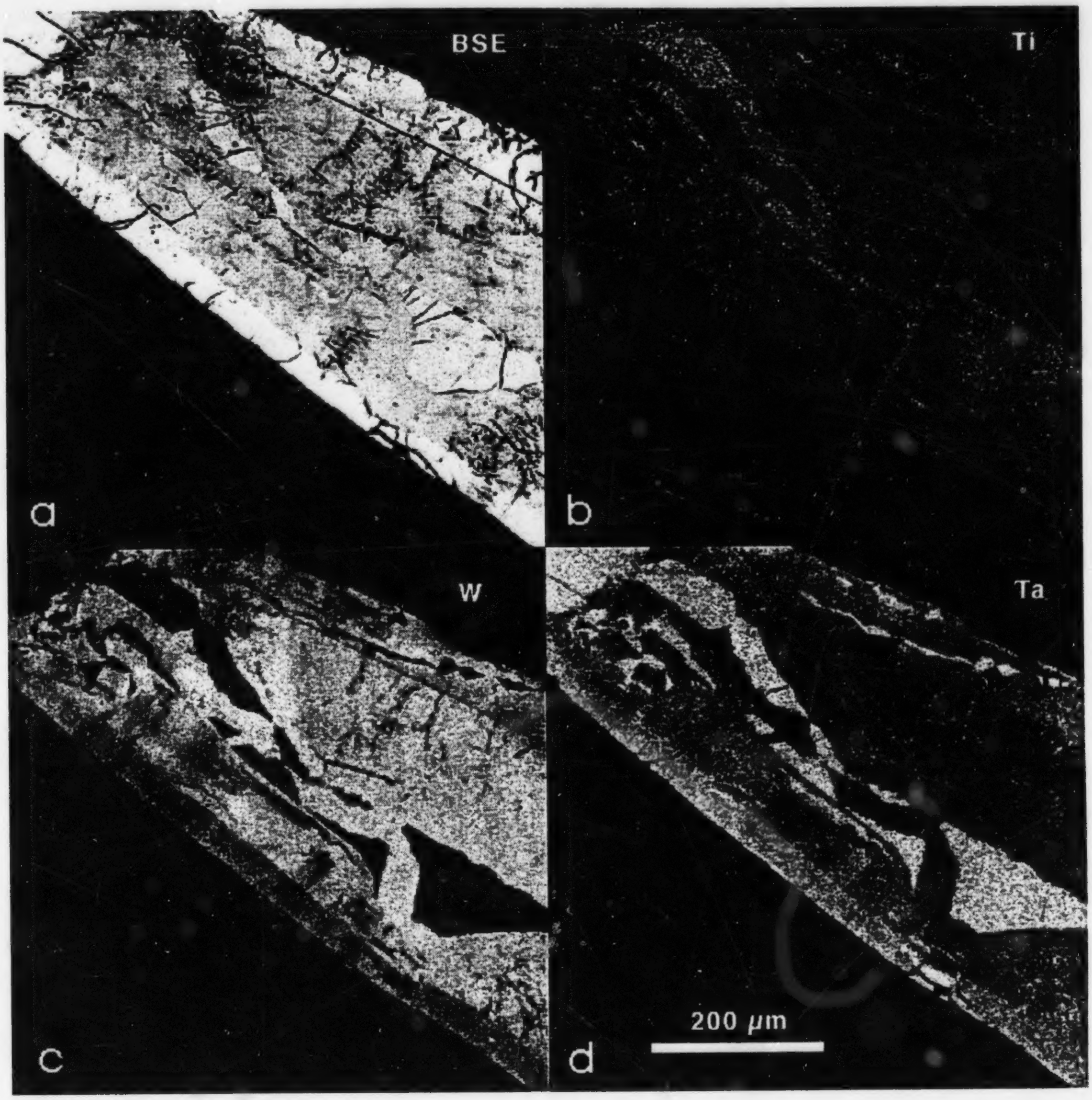

**Photo 8.** Backscattered electron and X-ray images of wodginite group minerals. (a) to (d) Wodginite - tungsteniferous wodginite with a thin, detached titanium-rich and tantalum-rich core (wodginite), mantled by tungsten-rich wodginite and a narrow rim containing less tungsten. Fe-suite eastern subgroup petalite pegmatite; Pegmatite 7, 94-Peg7E. Tungsten concentration in this grain is not sufficiently high to warrant description as a potentially new wodginite species.

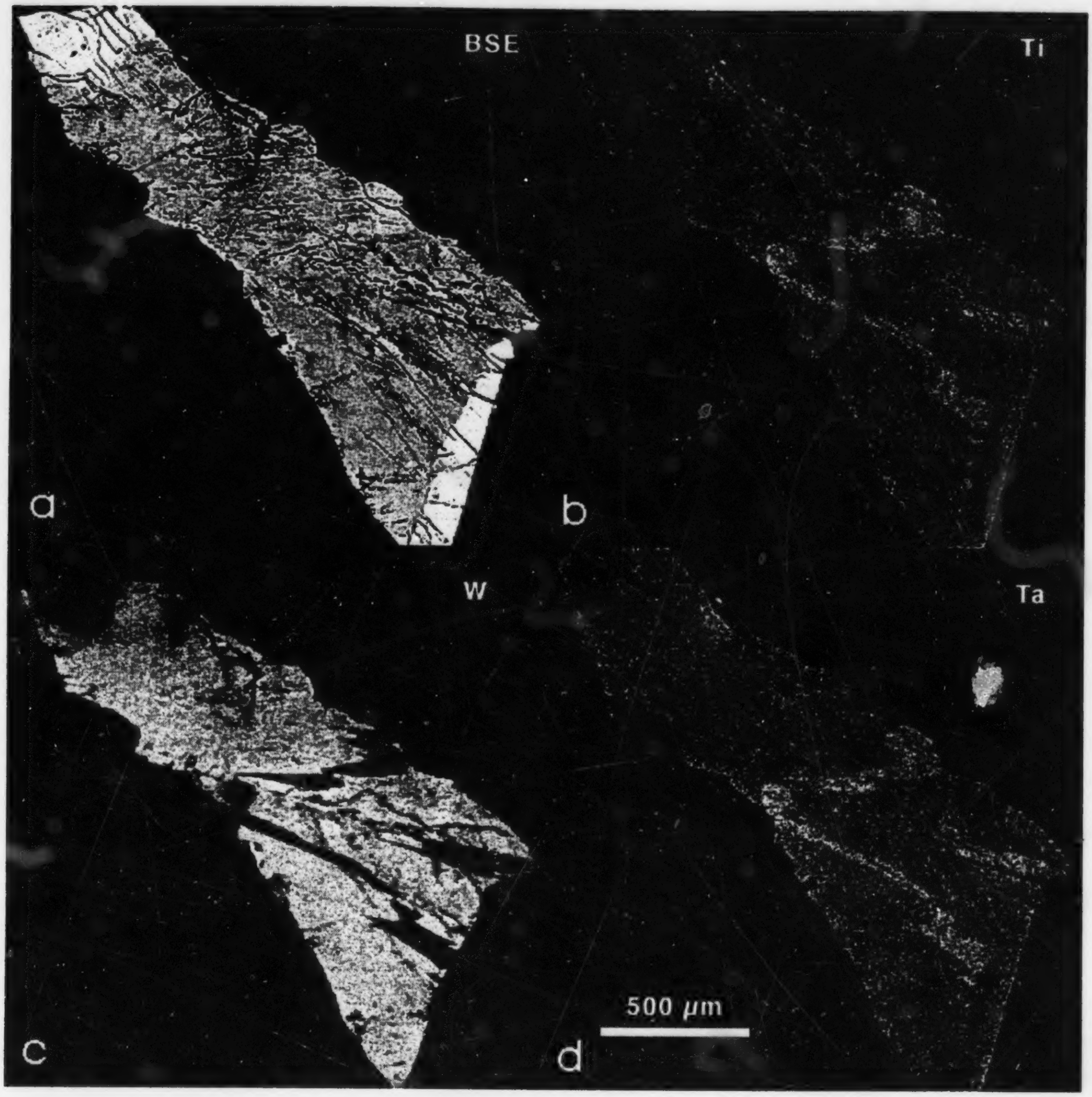

**Photo 9.** Backscattered electron and X-ray images of tungsteniferous wodginite. (a)-(d) Bulk of this grain is tungsteniferous wodginite through which a folded band of wodginite (low W) cuts. Ends of the grain are of a similar wodginite composition, but appear undeformed. Fe-suite eastern subgroup petalite pegmatite; Pegmatite 7, 94-Peg7E. Tungsten concentration in this grain is not sufficiently high to warrant description as a potentially new wodginite species, tentatively referred to as "wolframowodginite" by Tindle, Breaks and Webb (1998).

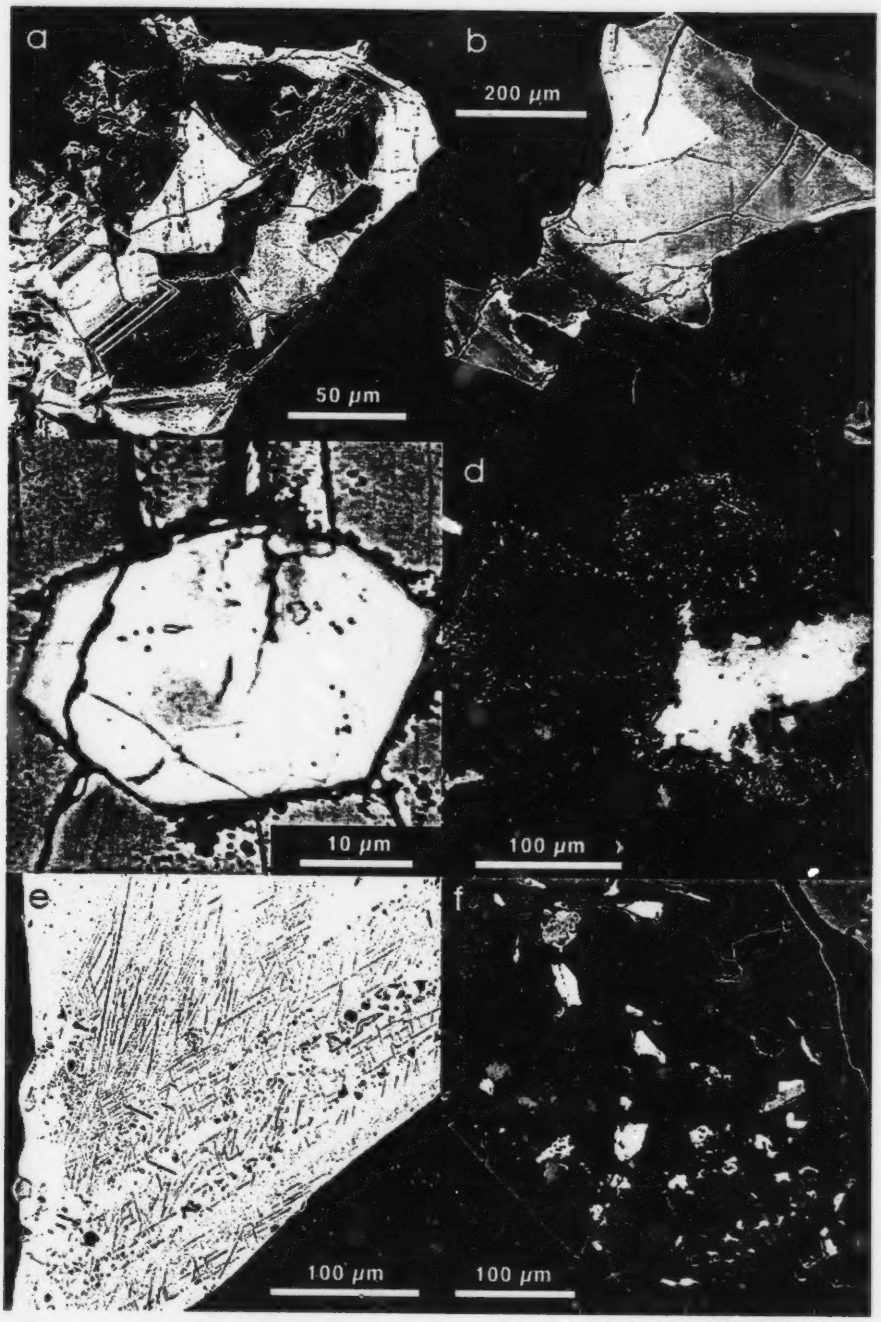

**Photo 10.** Backscattered electron images of pyrochlore group minerals. (a) Oscillatory zoned stibiomicrolite (dark region), partially mantled by microlite (top right). Core of grain is ferrotitanowodginite and all are included in cassiterite. Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44K. (b) Zoned antimonian microlite growing along margin of large cassiterite. Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 94-44J. (c) Euhedral uranmicrolite inclusion in large ferrowodginite. Fe-suite eastern subgroup petalite pegmatite; Pegmatite 5, 94-80D. (d) Yttropyrochlore partially replaced by yttrian pyrochlore. SW subgroup petalite pegmatite; Big Whopper, 96-29. (e) Euhedral cassiterite containing ferrocolumbite- and pore-rich zones alternating with inclusion-free zones criss-crossed with needle-shaped exsolution products (rutile?). SW subgroup beryl pegmatite; 96-15A. (f) Inclusion-rich cassiterite. Most inclusions are ferrocolumbite or ferrotantalite, but ferrotapiolite occurs occasionally (white grain near top left). Western extension of the Big Mack petalite system; Glitter pegmatite, 99-GZ4.

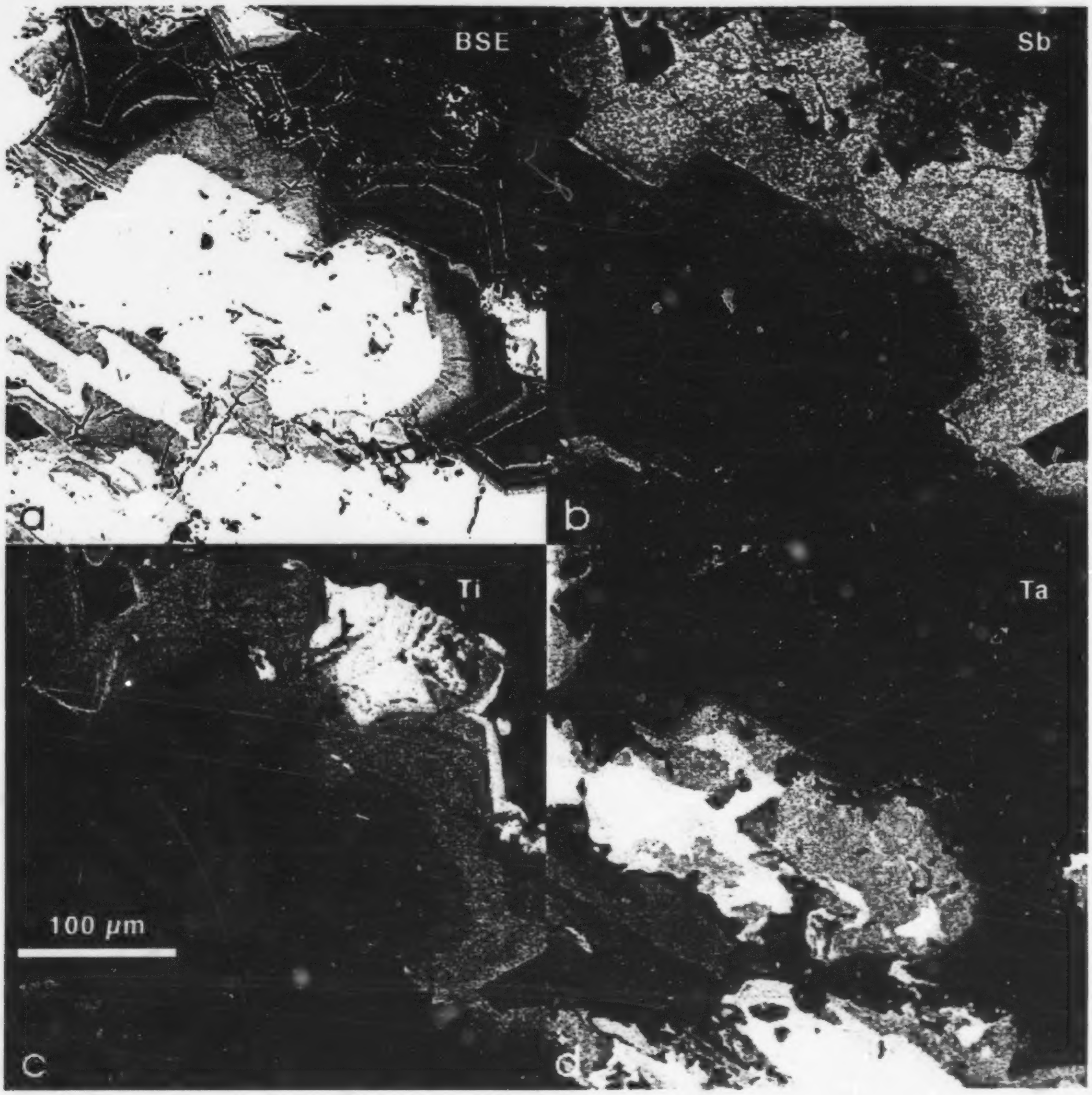

**Photo 11.** Backscattered electron and X-ray images of pyrochlore group minerals. (a) to (d) Stibiobetafite is the darker, oscillatory zoned mineral on the BSE image. It mantles earlier formed stibiomicrolite and microlite (bright regions on BSE image), which, in turn, partially replaces ferrocolumbite and ferrotantalite (bright regions on Ta map). Wall zone of Mn-suite eastern subgroup petalite pegmatite; Marko's, 96-AT1.

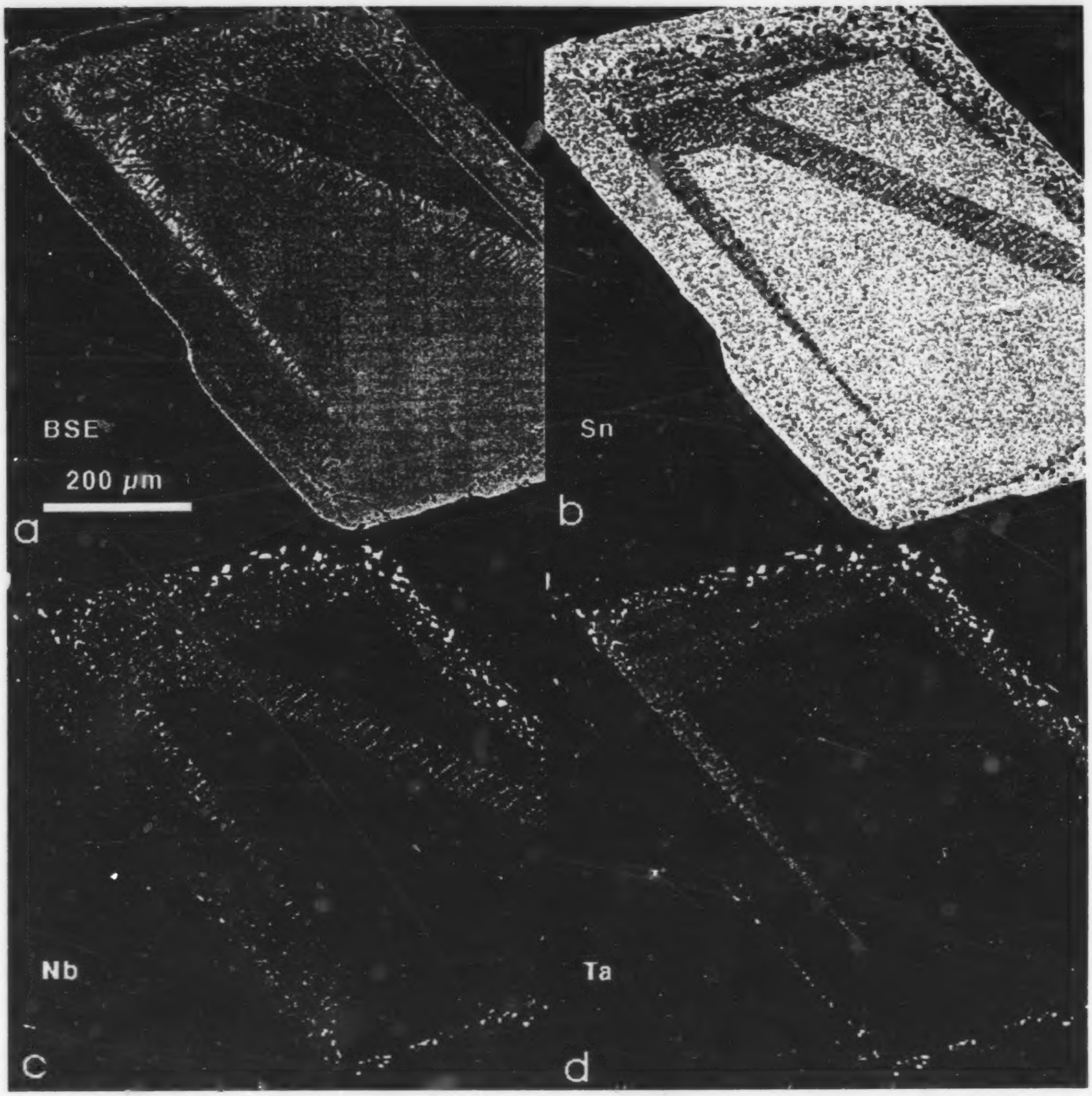

**Photo 12.** Backscattered electron and X-ray images of cassiterite. (a) to (d) Euhedral cassiterite containing ferrocolumbite inclusions (white spots on Nb and Ta maps) and with structurally controlled variation in minor element content. SW subgroup beryl pegmatite; 96-15A.

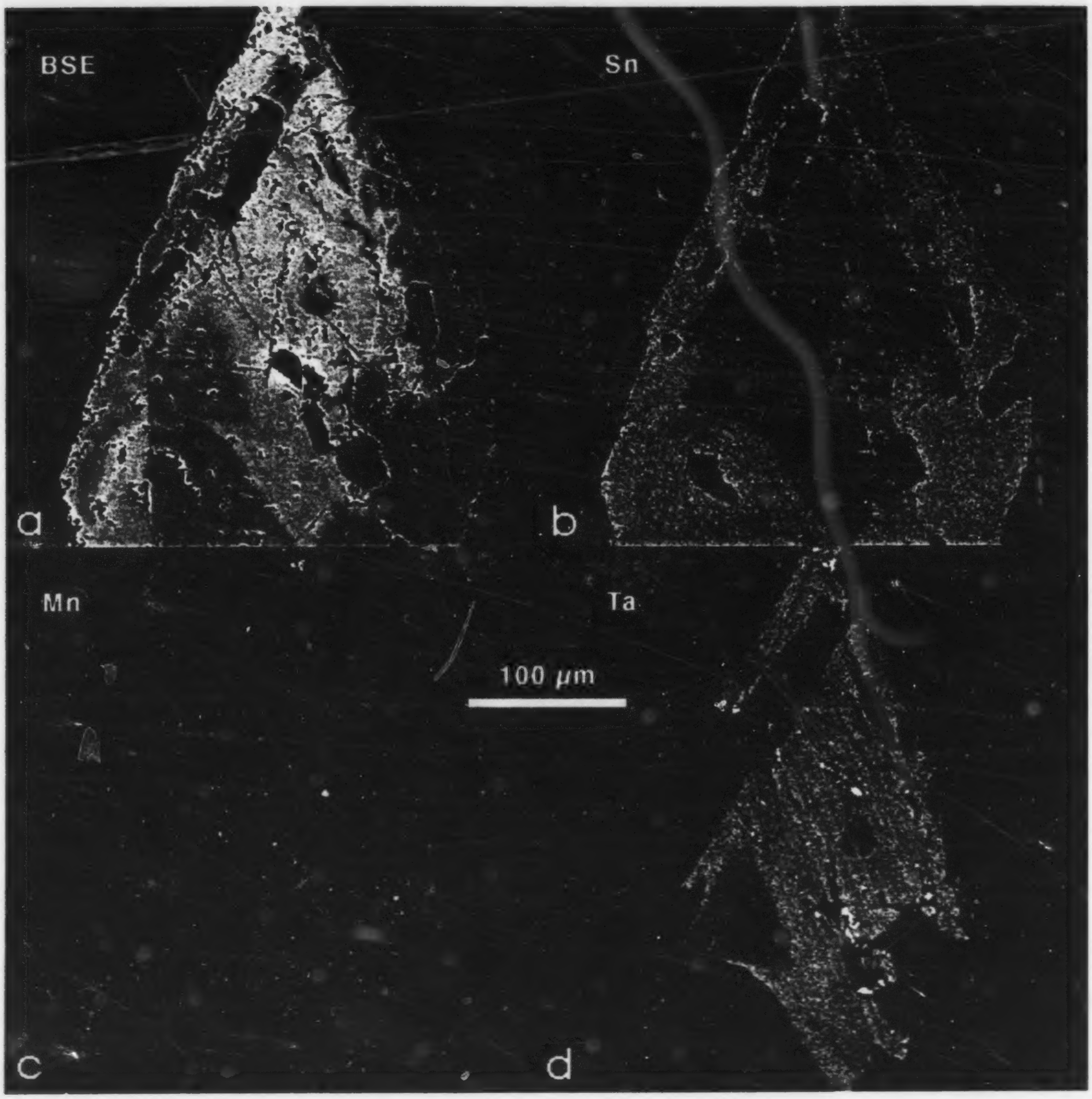

**Photo 13.** Backscattered electron and X-ray images of cassiterite. (a) to (d) Complex oscillatory zoned, euhedral cassiterite containing a niobium-tantalum-rich core region which appears to be in the process of being resorbed, recrystallized and overgrown by a more tin-rich variety. SW subgroup beryl pegmatite; 97-134A.

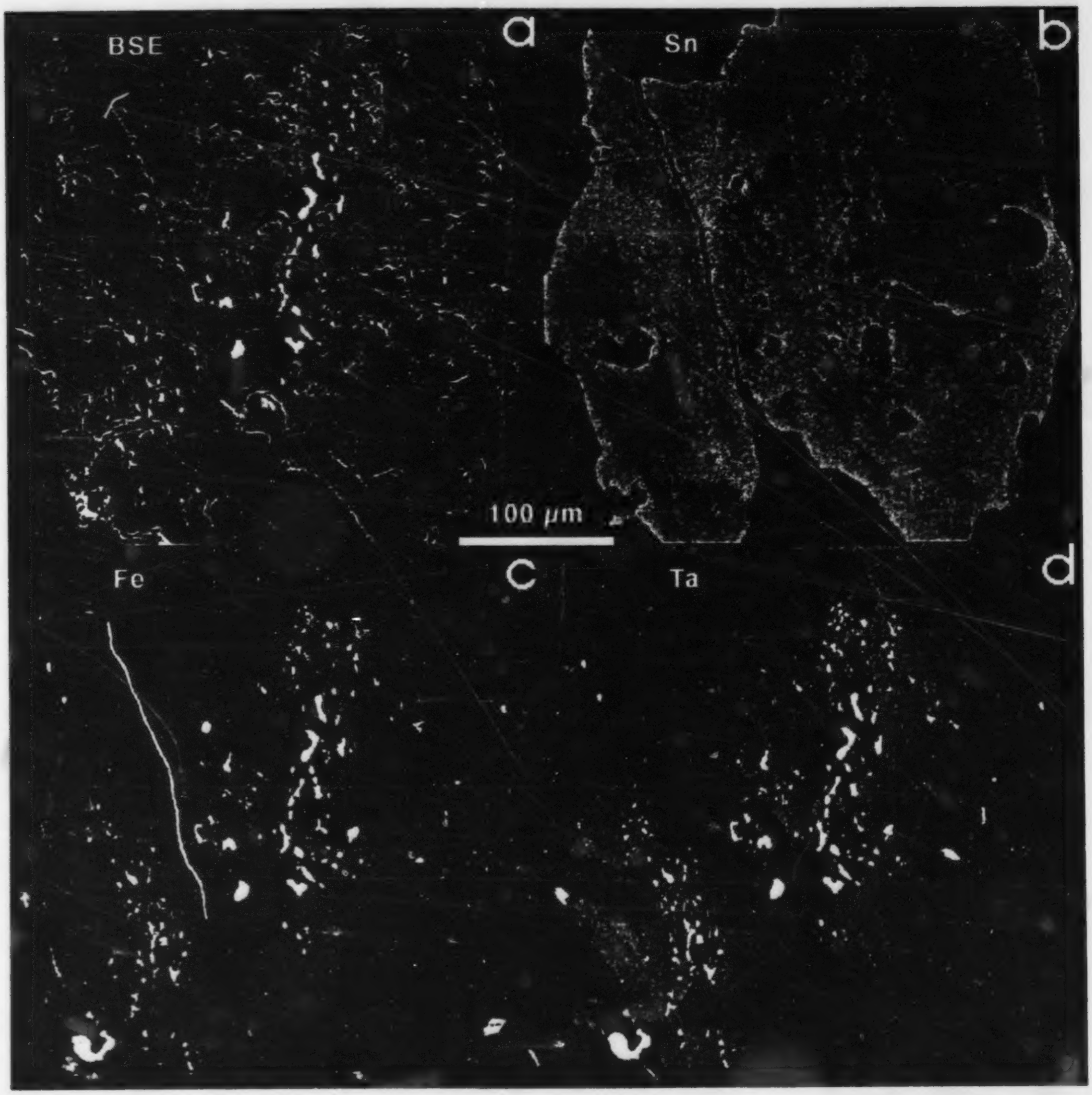

**Photo 14.** Backscattered electron and X-ray images of cassiterite. (a) to (d) Irregularly-shaped cassiterite comprising an earlier tantalum-rich variety that is being replaced by a more tin-rich variety. The white spots, visible in the Fe and Ta maps are ferrotapiolite and probably represent exsolved material rejected by the cassiterite structure (excess Fe and Ta) during the conversion of the early cassiterite to the later variety. Fe-suite eastern subgroup petalite pegmatite; Pegmatite 10, 97-P10-4.

**Table 1.** Means, ranges and standard deviations for all tantalum-bearing species from the Separation Lake area. In addition, details of those samples with minimum and maximum $Ta_2O_5$ values are included.

| | No. of samples | No. of analyses | Mean $Ta_2O_5$ | Std. Dev. | Min. $Ta_2O_5$ | | Max. $Ta_2O_5$ | |
|---|---|---|---|---|---|---|---|---|
| Columbite-tantalite group | 180 | 1758 | 40.77 | 16.35 | 4.01 | Zone 11 pegmatite: EFR-6082 | 84.06 | East Beryl pegmatite: 93-265A |
| Ferrotapiolite | 14 | 94 | 75.79 | 2.99 | 69.38 | SW Beryl pegmatite: 96-9 | 82.14 | SW Beryl pegmatite: 96-81 |
| Ixiolite | 8 | 21 | 36.66 | 12.57 | 2.19 | Treelined Lake Complex: 96-2 | 51.06 | Big Whopper pegmatite: 97-BW4 |
| Strüverite | 9 | 37 | 32.60 | 20.47 | 1.06 | Treelined Lake Complex: 96-2 | 60.78 | Big Mack pegmatite: 98-83Cii |
| Wodginite group | 64 | 617 | 55.48 | 10.05 | 12.66 | East Beryl pegmatite: 93-265A | 71.90 | Separation Rapids pluton: 96-72A |
| Pyrochlore group | 50 | 237 | 63.01 | 14.87 | 10.64 | Big Whopper pegmatite: 96-29G (Yttropyrochlore) | 80.08 | East Beryl pegmatite: 93-265Rii (Microlite) |
| Cassiterite | 151 | 1133 | 1.79 | 1.91 | 0.00 | SW Beryl pegmatite: 96-27 | 11.04 | Pegmatite 5: 94-80E |
| **Total** | | 3897 | | | | | | |

**Table 2.** Tantalum-bearing mineral associations from selected groups of samples from the Separation Lake area.

| Locations: | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Ferrocolumbite |  | • | • | • |  |  |  | • | • | • |
| Ferrotantalite | (•) | (•) |  | • |  |  |  | • | • | • |
| Manganocolumbite |  | (•) |  |  | • | • | • | • | (•) |  |
| Manganotantalite | (•) | • |  |  | • | • | • | • | • |  |
| Ferrotapiolite |  | (•) |  |  |  |  | (•) |  | (•) | • |
| Ferrowodginite |  | (•) | • | • |  |  | (•) |  | (•) | • |
| Wodginite |  |  |  | (•) | • | • | • | (•) | (•) |  |
| Titanowodginite |  |  |  |  |  |  | • | (•) |  |  |
| Ferrotitanowodginite |  |  |  |  |  |  | • |  | (•) |  |
| Tungsteniferous wodginite |  |  |  | • | • | • |  |  |  |  |
| Microlite | (•) |  |  | • | • | • | • | • | (•) |  |
| Stibiomicrolite |  |  |  | • |  |  | • |  |  |  |
| Bismutomicrolite |  |  |  |  | (•) |  |  |  |  |  |
| Uranmicrolite |  |  |  | • |  |  |  |  |  |  |
| Stibiobetafite |  |  |  |  |  |  | (•) |  |  |  |
| Yttropyrochlore |  |  |  |  |  |  |  | (•) |  |  |
| Yttrian pyrochlore |  |  |  |  |  |  |  | (•) |  |  |
| Ixiolite | (•) |  |  | • |  | (•) | (•) | (•) |  |  |
| Strüverite | (•) |  |  | • |  |  | • |  | • |  |
| Cassiterite | • | • | • | • | • | • | • | • | • | • |

Notes: (•) implies only found in one sample. Locations are as listed below:
1, Treelined Lake granitic complex (miarolitic pod);
2, Separation Rapids pluton;
3, Eastern subgroup Fe-suite beryl pegmatites;
4, Eastern subgroup Fe-suite petalite pegmatites;
5, Eastern subgroup Mn-suite beryl pegmatite;
6, Eastern subgroup Mn-suite petalite pegmatites;
7, Wall zone of Marko's pegmatite - an Eastern subgroup Mn-suite petalite pegmatite;
8, Big Whopper pegmatite, SW subgroup;
9, Big Mack pegmatite, SW subgroup Fe-suite (includes satellitic dikes);
10, Glitter pegmatite SW subgroup Fe-suite (Big Mack system).

**Table 3.** Summary of columbite-tantalite data from selected groups of samples from the Separation Lake area.

| | No. of samples | No. of analyses | Mean $Ta_2O_5$ | Std. Dev. |
|---|---|---|---|---|
| Treelined Lake Complex (miarolitic pod) | 1 | 21 | 38.73 | 7.86 |
| | | | | |
| Separation Rapids pluton (primitive) | 4 | 21 | 23.15 | 8.11 |
| Separation Rapids pluton (evolved) | 4 | 41 | 25.64 | 11.49 |
| Separation Rapids pluton (Li mica pods) | 3 | 33 | 59.15 | 8.26 |
| | | | | |
| **Beryl Pegmatites** | | | | |
| Eastern Fe-suite pegmatites | 15 | 114 | 26.09 | 15.43 |
| SW Fe-suite pegmatites (main) | 14 | 103 | 34.64 | 18.40 |
| SW Fe-suite pegmatites (ferrotapiolite) | 3 | 19 | 58.86 | 4.02 |
| SW Fe-suite pegmatites (Big Mack system) | 3 | 87 | 45.31 | 11.34 |
| Eastern Mn-suite pegmatites (all) | 13 | 151 | 46.07 | 17.35 |
| Eastern Mn-suite pegmatite (93-265) | 7 | 91 | 44.62 | 15.54 |
| SW Mn-suite pegmatites (all) | 6 | 139 | 46.84 | 9.68 |
| SW Mn-suite Wolf pegmatite | 4 | 23 | 32.09 | 4.99 |
| | | | | |
| **Eastern Petalite Pegmatites** | | | | |
| Pegmatite 1 | 2 | 10 | 28.93 | 8.79 |
| Pegmatite 5 | 1 | 6 | 53.90 | 0.26 |
| Pegmatite 7 | 2 | 19 | 50.04 | 4.53 |
| Pegmatite 8 | 1 | 3 | 22.41 | 4.33 |
| Pegmatite 9 | 1 | 26 | 45.32 | 7.88 |
| Pegmatite 10 | 5 | 51 | 42.98 | 8.51 |
| Pegmatite 11 | 3 | 10 | 49.52 | 12.08 |
| James' pegmatite | 1 | 4 | 54.02 | 0.99 |
| Lou's pegmatite | 4 | 85 | 44.20 | 9.75 |
| Marko's pegmatite (all samples) | 27 | 284 | 39.02 | 15.36 |
| Marko's pegmatite - wall zone | 10 | 66 | 34.65 | 14.59 |
| Marko's pegmatite - layered pegmatite-aplite | 4 | 40 | 27.40 | 2.46 |
| Marko's pegmatite - petalite core zone | 7 | 118 | 49.45 | 14.45 |
| | | | | |
| **SW Petalite Pegmatites** | | | | |
| Pegmatite 12 | 1 | 1 | 38.11 | - |
| Pegmatite 14 | 1 | 2 | 36.06 | 5.22 |
| Big Mack pegmatite | 8 | 44 | 46.30 | 14.96 |
| Zone 11 pegmatite (Big Mack system) | 1 | 7 | 5.75 | 1.21 |
| 6059 pegmatite (Big Mack system) | 1 | 11 | 56.57 | 14.63 |
| Glitter pegmatite (Big Mack system) | 6 | 51 | 37.92 | 12.00 |
| Big Whopper pegmatite* | 24 | 273 | 41.60 | 18.66 |
| Big Whopper pegmatite (lepidolite unit) | 4 | 31 | 51.57 | 7.30 |
| Bob's pegmatite (Big Whopper system) | 3 | 7 | 40.13 | 14.61 |
| Great White North pegmatite (Big Whopper system) | 5 | 42 | 34.82 | 17.16 |
| School of Fish pegmatite (Big Whopper system) | 3 | 18 | 40.65 | 17.21 |
| Swamp pegmatite (Big Whopper system) | 1 | 17 | 60.19 | 7.62 |
| West pegmatite (Big Whopper system) | 3 | 23 | 37.52 | 11.87 |

Note: * sample 97-BW5 excluded

**Table 4.** Summary of ferrotapiolite data from selected groups of samples from the Separation Rapids pluton and pegmatites.

| Location | Sample No. | | Abundance |
|---|---|---|---|
| Separation Rapids pluton | 96-72A | associated with ferrowodginite | significant |
| **Beryl Pegmatites** | | | |
| SW Beryl pegmatite | 96-9 | associated with ferrotantalite | significant |
| SW Beryl pegmatite | 96-11A | inclusion in cassiterite | very minor |
| SW Beryl pegmatite | 96-53A | incl. in cassiterite, assoc. ferrotantalite | minor |
| SW Beryl pegmatite | 96-81 | associated with ferrotantalite | significant |
| SW Beryl pegmatite | 96-81X | isolated grain | minor |
| SW Beryl pegmatite | 97-69 | inclusion in cassiterite | minor |
| **Petalite Pegmatites** | | | |
| Pegmatite 5 | 94-80P | associated with wodginite | very minor |
| Pegmatite 10 | 97-P10-1 | inclusion in cassiterite | minor |
| Pegmatite 10 | 97-P10-4 | exsolved blobs in cassiterite | minor |
| School of Fish pegmatite | 97-71 | many grains close to a tourmaline/microlite-rich veinlet | minor |
| Big Mack pegmatite | 98-83F | clusters of large grains | most significant |
| Glitter pegmatite | 99-GZ1 | inclusion in cassiterite | minor |
| Glitter pegmatite | 99-GZ4 | inclusion in cassiterite | minor |
| Marko's pegmatite | 94-44Z | "ferrotapiolite" partially replaced by "microlite" | significant |

**Table 5.** Summary of wodginite group data from selected groups of samples from the Separation Rapids pluton and pegmatites.

| | No. of samples | No. of analyses | Mean $Ta_2O_5$ | Std. Dev. |
|---|---|---|---|---|
| Separation Rapids pluton (evolved) | 1 | 14 | 67.92 | 4.64 |
| Separation Rapids pluton (Li mica pods) | 1 | 2 | 62.08 | 0.93 |
| **Beryl Pegmatites** | | | | |
| Eastern Fe-suite pegmatites | 2 | 8 | 63.59 | 4.04 |
| SW Fe-suite pegmatites | 2 | 7 | 58.52 | 3.32 |
| Eastern Mn-suite pegmatite (93-265) | 3 | 38 | 56.91 | 10.96 |
| **Eastern Petalite Pegmatites** | | | | |
| Pegmatite 5 | 9 | 152 | 50.63 | 10.85 |
| Pegmatite 6 | 1 | 60 | 39.08 | 5.08 |
| Pegmatite 7 | 4 | 98 | 60.59 | 4.77 |
| Pegmatite 9 | 1 | 1 | 55.08 | - |
| Pegmatite 10 | 2 | 11 | 57.03 | 6.82 |
| James' pegmatite | 1 | 6 | 56.51 | 1.05 |
| Lou's pegmatite | 3 | 7 | 56.64 | 3.32 |
| Marko's pegmatite (all samples) | 24 | 175 | 60.36 | 4.33 |
| Marko's pegmatite - wall zone Fe & Ti wodginite | 11 | 119 | 58.51 | 3.89 |
| Marko's pegmatite - bulk of pegmatite | 13 | 56 | 64.31 | 1.88 |
| **SW Petalite Pegmatites** | | | | |
| Big Mack pegmatite | 2 | 8 | 54.37 | 3.13 |
| Glitter pegmatite (Big Mack system) | 2 | 6 | 58.43 | 2.42 |
| Big Whopper pegmatite | 3 | 12 | 61.09 | 2.88 |
| Great White North pegmatite (Big Whopper system) | 1 | 1 | 58.27 | - |
| West pegmatite (Big Whopper system) | 1 | 10 | 52.67 | 2.66 |

**Table 6.** Summary of pyrochlore group data from selected groups of samples from the Separation Lake area.

| | No. of samples | No. of analyses | Mean $Ta_2O_5$ | Std. Dev. |
|---|---|---|---|---|
| **Microlite** | | | | |
| Treelined Lake Complex | 1 | 5 | 71.46 | 2.06 |
| Eastern Mn-suite beryl pegmatite (93-265) | 1 | 3 | 78.93 | 1.01 |
| SW Fe-suite beryl pegmatites | 4 | 13 | 68.51 | 5.15 |
| SW Mn-suite beryl pegmatite - Wolf pegmatite | 1 | 2 | 68.92 | 1.44 |
| Eastern Fe-suite petalite Pegmatite 5 | 1 | 3 | 62.81 | 9.43 |
| Eastern Fe-suite petalite Pegmatite 7 | 2 | 5 | 59.36 | 10.76 |
| SW petalite Big Whopper pegmatite | 3 | 9 | 70.82 | 2.77 |
| SW petalite School of Fish pegmatite | 3 | 28 | 68.10 | 4.78 |
| Eastern Mn-suite petalite Marko's pegmatite (all samples) | 17 | 56 | 72.32 | 4.05 |
| **Antimonian microlite** | | | | |
| Eastern Mn-suite petalite Marko's pegmatite (wall zone) | 3 | 20 | 59.81 | 2.62 |
| **Stibiomicrolite** | | | | |
| Eastern Fe-suite petalite - Lou's pegmatite | 3 | 7 | 53.51 | 7.62 |
| Eastern Mn-suite petalite Marko's pegmatite (mainly wall zone) | 4 | 14 | 48.71 | 3.68 |
| **Stibiobetafite** | | | | |
| Eastern Mn-suite petalite Marko's pegmatite (wall zone) | 1 | 1 | 21.82 | 5.91 |
| **Sb/U microlite** | | | | |
| Eastern Mn-suite petalite Marko's pegmatite (wall zone) | 2 | 2 | 54.73 | 15.41 |
| **Uranoan microlite** | | | | |
| SW petalite pegmatite - Big Whopper pegmatite | 2 | 2 | 67.89 | 0.49 |
| **Uranmicrolite** | | | | |
| Eastern Fe-suite petalite pegmatite - Pegmatite 5 | 2 | 4 | 65.71 | 1.53 |
| **Yttropyrochlore & yttrian pyrochlore** | | | | |
| SW petalite pegmatite - Big Whopper pegmatite | 1 | 8 | 13.06 | 1.34 |
| **Bismutomicrolite** | | | | |
| Eastern Mn-suite Beryl pegmatite (93-265) | 1 | 3 | 40.16 | 2.58 |
| **Microlite-like (after ferrotapiolite)** | | | | |
| Eastern Mn-suite petalite Marko's pegmatite | 1 | 7 | 75.06 | 1.07 |

**Table 7.** Summary of cassiterite data from selected groups of samples from the Separation Rapids Lake area.

| | No. of samples | No. of analyses | Mean $Ta_2O_5$ | Std. Dev. |
|---|---|---|---|---|
| Treelined Lake Complex | 2 | 5 | 1.44 | 0.48 |
| | | | | |
| Separation Rapids pluton (evolved) | 2 | 11 | 0.97 | 0.62 |
| Separation Rapids pluton (Li mica pods) | 2 | 19 | 3.06 | 1.31 |
| | | | | |
| **Beryl Pegmatites** | | | | |
| Eastern Fe-suite pegmatite - Audrey's pegmatite | 1 | 2 | 1.31 | 0.24 |
| SW Fe-suite pegmatites (all) | 20 | 177 | 1.25 | 1.20 |
| Eastern Mn-suite pegmatites (all) | 6 | 22 | 1.81 | 0.84 |
| SW Mn-suite Wolf pegmatite | 4 | 29 | 1.66 | 1.02 |
| SW Mn-suite pegmatites (Li-mica pods) | 2 | 12 | 1.52 | 1.49 |
| | | | | |
| **Eastern Petalite Pegmatites** | | | | |
| Pegmatite 5 | 8 | 75 | 4.27 | 3.36 |
| Pegmatite 6 | 2 | 10 | 5.33 | 3.74 |
| Pegmatite 7 | 6 | 34 | 1.83 | 1.37 |
| Pegmatite 9 | 1 | 5 | 0.81 | 0.57 |
| Pegmatite 10 | 5 | 106 | 3.01 | 2.63 |
| Pegmatite 11 | 2 | 4 | 0.74 | 0.24 |
| James' pegmatite | 6 | 31 | 1.72 | 1.10 |
| Lou's pegmatite | 2 | 18 | 2.24 | 0.92 |
| Marko's pegmatite (all samples) | 28 | 150 | 1.66 | 1.33 |
| Marko's pegmatite - wall zone | 14 | 83 | 1.53 | 1.23 |
| Marko's pegmatite - layered pegmatite-aplite | 4 | 16 | 1.47 | 1.52 |
| Marko's pegmatite - petalite core zone | 8 | 33 | 1.91 | 0.97 |
| | | | | |
| **SW Petalite Pegmatites** | | | | |
| Pegmatite 12 | 2 | 9 | 0.39 | 0.58 |
| Pegmatite 14 | 3 | 16 | 0.68 | 0.57 |
| Big Mack pegmatite | 2 | 16 | 2.15 | 1.15 |
| Zone 11 pegmatites (Big Mack system) | 1 | 50 | 1.28 | 0.83 |
| 6059 pegmatite (Big Mack system) | 1 | 15 | 0.82 | 0.69 |
| Glitter pegmatite (Big Mack system) | 4 | 26 | 0.99 | 0.63 |
| Big Whopper pegmatite* | 25 | 218 | 1.28 | 2.46 |
| Big Whopper pegmatite (lepidolite unit) | 1 | 9 | 1.03 | 2.48 |
| Bob's pegmatite (Big Whopper system) | 3 | 19 | 1.57 | 1.36 |
| Great White North pegmatite (Big Whopper system) | 6 | 47 | 1.44 | 1.37 |
| School of Fish pegmatite (Big Whopper system) | 2 | 11 | 1.26 | 1.65 |
| Swamp pegmatite (Big Whopper system) | 1 | 14 | 0.92 | 1.25 |
| West pegmatite (Big Whopper system) | 2 | 22 | 0.88 | 0.59 |

Note: * sample 97-BW5 excluded

# Appendix A: Sample Descriptions for Separation Rapids Rare-Element Pegmatite Group

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# TREELINED LAKE GRANITIC COMPLEX

**94-84A**: Four, black mineral-bearing fragments from tourmaline-cassiterite-topaz-green muscovite-quartz-bearing miarolitic cavities. The three largest fragments are dominantly quartz with inclusions of possible oxide minerals (or tourmaline). Note that the intermediate size, quartz-rich fragment has a nice cluster of platy manganotantalite (X-ray diffraction indicated, and electron microprobe confirmed, some manganotantalite, but most is manganocolumbite) at least 8 mm in length. The fourth fragment contains a much smaller, platy oxide, possibly tantalite. Some of these black mineral inclusions are tourmaline (schörl-elbaite).

**94-84B**: Several fragments of dark brown cassiterite from same miarolitic cavity. It may be interesting to search for possible wodginite inclusions in the cassiterite. Ferrocolumbite was also reported by the X-ray diffraction scan and possibly represent small inclusions.

**94-84C**: A 4 by 5 mm grain of grey-black anatase, confirmed by X-ray diffraction, from a different part of the outcrop than that which contains the miarolitic cavities. The mineral is found in biotite-muscovite-quartz clots hosted in a medium-grained, muscovite-biotite granite.

**94-84E**: Two small fragments from a single dark brown crystal. This euhedral mineral occurs within a cleavelandite lath and partly contacts a fine-grained, mauve mica coating on the lath. The mica coating marks the edge of a miarolitic cavity. Mica sent in for X-ray diffraction (possible lepidolite alteration). Microlite, cassiterite and ferrotantalite found.

**95-40A**: Small piece from a 1 by 4 cm, muscovite-biotite-rich clot from garnet-biotite granite (Treelined Lake granitic complex). The light green mineral possibly is gahnite.

**95-40B**: Fragments from a dark brittle mineral enveloped by fibrolite in a muscovite-biotite-rich clot. A second clot from same granite as 95-40A. The dark mineral is gahnite.

**96-2: South Harrison graphite occurrence (Trout Lake).** Graphite-rich, muscovite pegmatite dike situated in metasedimentary migmatite terrain adjacent to the northeastern contact of the Treelined Lake granitic complex. Pegmatite also contains local black tourmaline, coarse muscovite books and sparse black, possible oxide minerals (niobian rutile with inclusions of manganocolumbite indicated by electron microprobe).

# SEPARATION RAPIDS PLUTON

**93-249A**: Fine-grained biotite-muscovite-garnet leucogranite containing ferrocolumbite.

**93-249B**: Sample which contains part of an original megacryst, possibly after cordierite, now completely replaced by garnet-muscovite-biotite and local light blue beryl. The muscovite pegmatitic leucogranite host contains sporadic ferrocolumbite.

**93-249C**: Part of an euhedral crystal of ferrocolumbite, 2 by 8 mm in cross-section and mainly contained within quartz. Host rock is a fine-grained muscovite-biotite leucogranite which locally grades into patches of potassic pegmatite.

**93-249i**: Black oxides from beryl-garnet-biotite, mafic-rich segregations thought to be after primary cordierite. One plastic vial contains a complete euhedral crystal (1.5 by 2.5 by 4 mm). Hematite?

**93-251**: Garnet-muscovite granodiorite with perhaps a trace of biotite. Rock contains scarce, minute, rod-like and square-shaped black minerals (ferrocolumbite), the latter with red, secondary alteration halos. Local lime-green beryl occurs in same outcrop, but is not found in electron microprobe sample.

**93-260**: Fragments from large cassiterite from southwestern part of pluton.

**93-260A**: Several fragments of brown manganotantalite. Mineral comes from a green muscovite-cleavelandite mass (10 by 20 cm) in a large mass of potassic pegmatite. The oxide, intergrown with the cleavelandite, occurs as euhedral crystals up to 2 to 4 by 4 by 7 mm. Noteworthy is the rare phosphate mineral alluaudite in the muscovite-cleavelandite mass. Also noted is the overprint of adjacent potassium feldspar adjacent to white cleavelandite laths, hence the muscovite-cleavelandite assemblage may be of replacement origin.

**93-260B**: Pieces of a small platy, black manganocolumbite intergrown with cleavelandite in the same muscovite-cleavelandite mass as that hosting 93-260A.

**93-260C**: More oxide fragments from the 2 by 3 m cleavelandite-rich pod where Mn-tantalite was documented. The dark brown fragments of cassiterite, originate from a 2 by 6 cm tapered crystal. Inclusions of manganotantalite and ferrotantalite are present together with lesser wodginite. Note also that the dike at 94-15, with ferrowodginite and cassiterite, is situated 90 m south.

**96-72**: Two outcrops of pegmatitic granite of Separation Rapids pluton directly across the bay from 93-260. Two samples were collected:

**96-72A**: Possible cassiterite from garnet-muscovite potassic pegmatite outcrop on shoreline. The cassiterite coexists with beryl in a muscovite + quartz-rich pegmatite patch. No cassiterite found with electron microprobe, only large grains of wodginite and ferrowodginite associated with equally large ferrotapiolite grains.

**96-72B**: Outcrop 30 m in the bush and south of 96-72B. The south face of outcrop contains a 1 m thick zone rich in green beryl, and equant to platy oxides (cassiterite and ferrocolumbite).

**98-248**: Resample of locality 93-249, with rock units described under 93-249A, 93-249B, 93-249C and 93-249i, above. Ferrocolumbite (mainly) and ferrotantalite present.

# EASTERN PEGMATITE SUBGROUP

## Eastern Beryl Zone

### PEGMATITES NEAR SOUTHEASTERN END OF SEPARATION RAPIDS PLUTON

**93-262A**: Evolved exocontact dike-like mass partly exposed on island and which could represent the eastern terminus of Separation Rapids pluton. Sample comprises a garnet-muscovite-quartz-plagioclase rock that contains sporadic ferrocolumbite and light green, 1 to 6 cm diameter beryl. Ragged potassium feldspar occurs in the hand specimen.

**93-262B**: Possible albitite, which grades into 93-262A. Scattered, sparse, fine-grained, equant to platy, oxide minerals (ferrocolumbite and ferrotantalite), up to 3 mm diameter, hosted in a beryl-garnet-muscovite-quartz-blocky potassium feldspar-plagioclase assemblage. Parts of the unit, which is situated within 2 m of the southern dike contact, contains up to 11.45% $Na_2O$ and is classed as albitite. Small miarolitic cavities with projecting quartz crystals and goethite as infilling phases are sparsely evident. Pyrite, zircon, thorium-rich monazite and xenotime also found.

**93-262C**: Platy black ferrocolumbite, 1 by 5 mm, mainly contained in plagioclase and with a slight penetration into quartz.

**93-262D**: Platy black ferrocolumbite in garnet-muscovite-quartz-plagioclase unit that lies adjacent to beryl-potassium feldspar-quartz core unit.

**93-263**: Garnet-muscovite-quartz-plagioclase aplite dike situated 15 m south of 93-262 locality and hosted in amphibolite. The aplite contains very fine-grained oxides (manganotantalite) which tend to correspond to the rust halos. Several cut surfaces have intersected an unknown, red-brown, possibly altered mineral. Some grains contain a yellow-green core (at arrow ends). Channel sample over 113 cm (93FWB-263) gives bulk composition of the aplite.

**93-264A**: Cassiterite in muscovite-beryl-quartz-plagioclase rock from 8 m thick dike. Fine-grained, pseudomorphs of possible ephesite after a 0.5 to 2 cm diameter square-shaped, former primary phase occurs 0.3 m from sample location. Unit was sampled by channel cut over 160 cm (93FWB-264).

**94-29**: Near southern contact of Separation Rapids pluton and on island west of locality 93-265. Sample of vaguely foliated, biotite-muscovite-garnet granite with black oxides (ferrocolumbite) and dark green, subhedral to euhedral gahnite (confirmed by X-ray diffraction). Cadmium-rich sphalerite and microlite also present. The largest ferrocolumbite is included in sample sent and is a 2 by 6 mm, tabular euhedral crystal which slightly protrudes above surface. Note that it contacts a small grain of gahnite.

**94-29A**: Several pieces of a gahnite-biotite-garnet-muscovite-potassium feldspar-quartz-plagioclase rock that has also been sent in for bulk analysis. Sample located near previously sent material (94-29) with the cadmium-rich sphalerite. Specks of minute platy and equant, anhedral, black, ferrocolumbite have been circled on slabs. The potassium feldspar megacrysts are ductily deformed and generally enveloped by masses rich in fine-grained plagioclase, although it is not clear whether this represents incipient alteration of the potassium feldspar. The black oxide specks and the gahnite are not restricted to the plagioclase-rich masses alone as they also occur within quartz and more rarely in garnet.

### PEGMATITE 93-265

**93-265A**: A section oriented roughly parallel to the c-axis of a 3 cm diameter book of muscovite. The muscovite exhibits marginal replacement by a purple mica mineral (lepidolite) and cleavelandite. The purple mica occurs in a rare-element-enriched pod (1 by 10 m) of a 6 m thick pegmatite dike near the eastern end of the Separation Rapids pluton. Associated phases include blocky potassium feldspar, quartz, white beryl, cleavelandite, fluorapatite, cassiterite, wodginite, manganotantalite and bismutomicrolite. This is the most evolved sample from the Eastern beryl zone.

**93-265F**: Part of a 3 cm wide, black cassiterite crystal just below the triangular oxide. The sample fragment contains one of the crystal faces, marked by white dot.

**93-265J**: 1 by 3 mm, platy manganocolumbite and manganotantalite (associated iron stains) which occurs in a muscovite-quartz-cleavelandite assemblage from largest pod near lake shore.

**93-265K**: 7 by 13 mm, euhedral, cassiterite (looks twinned) associated with muscovite-quartz-cleavelandite from loose boulder about midway along the pegmatite and near to locality with the spectacular triangular-shaped coarse brown cassiterite crystal.

**93-265N**: Manganocolumbite from a composite aplite-pegmatite sample that may be critical in better assessing the fractionation of Ta versus Nb in the most evolved part of the Separation Rapids pluton. Three areas that contain oxide minerals extend from the outermost part of an aplite layer, virtually depleted in micas minerals, inward to the pegmatite pod itself as detailed below:

**93-265N(i)**: 1 mm black oxide grain (manganocolumbite) situated 4.5 cm from pegmatite contact. Cassiterite also present.

**93-265N(ii)**: <1 mm black oxide grains (manganocolumbite) very near pegmatite contact.

**93-265N(iii)**: fragments chipped from a 1 by 5 by 7 mm, tabular, black mineral located 1.5 cm into the pegmatite pod. There is a small amount of rusty alteration coating the mineral (metamict material?). The oxide lies mainly between cleavelandite laths, but is very close to dark green elbaite and an euhedral dark brown, probable cassiterite crystal. Electron microprobe work revealed elbaite tourmaline only.

**93-265P**: Two saw-cut pieces from same large block. Most of the sample is representative of the main unit of the pegmatite mass: a potassium feldspar-muscovite-plagioclase-quartz assemblage. A small mass rich in cleavelandite occurs at the edge of the largest piece. Fine-grained needle, platy and roughly equant black manganocolumbite and cassiterite are subtly present, some of which coincide with small rust halos. The acicular oxides occur mostly in quartz and rarely in starburst-like concentrations (labelled on specimen and best observed with binocular microscope).

**93-265Q**: Another sample from the main pegmatite unit, but considerably further from the mica-cleavelandite pods. Several minute manganocolumbite grains and a black monazite grain were found.

**93-265R**: Apatite-rich sample containing manganotantalite and microlite.

**96-82**: Oxide material from two narrow aplite dikes (96-82A and 96-82B, below) on same island as 93-265 and about 200 m to the east. This locality lies about midway between the nearest petalite occurrence (94-34: Pegmatite 1) and locality 93-265.

**96-82A**: Very rare black specks of zoned ferrocolumbite-ferrotantalite in pieces of biotite-muscovite aplite. One piece was taken next to contact and has a small remnant of the host-rock. Nigerite also present.

**96-82B**: Fragments from an euhedral, glossy black, rectangular mineral, most of which was extracted from the dike (about 1 by 3 by 8 mm). Indicated by electron microprobe work as a large oscillatory zoned ferrocolumbite core to ferrotantalite rimmed crystal.

**97-1A**: Muscovite-quartz-plagioclase assemblage situated about 15 m from the highly evolved core with tungsten-bearing wodginite. Sample comprises fragments and complete crystal sections of black, oxide minerals (ferrocolumbite, manganocolumbite, manganotantalite and wodginite). Elbaite tourmaline also present.

## AUDREY'S PEGMATITE

**93-271**: Apatite-garnet-biotite granite with a 2 by 6 mm cassiterite crystal. Fine-grained oxides include ferrocolumbite, wodginite and cassiterite. Xenotime also present.

## PEGMATITE 93-304

**94-304**: Muscovite-garnet aplite with numerous black manganocolumbite specks and scarcer, fine-grained, red-brown mineral (cassiterite?). The rock also contains possible topaz, at arrow end: this mineral was identified in the nearby, biotite-rich metasomatic reaction zone in the host amphibolite.

**94-304A**: Several cut pieces from topaz-garnet-muscovite aplite dike at west end of small island. Circled areas point out black oxide specks. This material is similar to that previously analyzed (94-304). Both are manganocolumbite.

**94-304B**: Several pieces from a garnet-potassium feldspar-topaz-muscovite-plagioclase-quartz unit from new topaz dikes found at opposite end of small island that also contains topaz-bearing aplite dikes (94-304A). A few black specks of possible oxide minerals are pointed by the arrows (94-304i, 94-304ii, and 94-304iii):

- 1 mm long grain mostly enveloped by fine-grained plagioclase, but also in contact with an altered crystal of topaz.
- 1 mm grain mostly in grey quartz, but also touching plagioclase.
- 0.5 mm grain completely in plagioclase.

The large slab cuts have revealed some nice textures involving a progressive replacement of citrine-coloured topaz megacrysts by fine-grained, green muscovite. Large primary muscovite and potassium feldspar also in same assemblage and are also marginally replaced by the fine-grained muscovite. Also two types of plagioclase present and the odd small white beryl.

**94-304C**: Relatively coarse, black mass of cassiterite with ferrocolumbite and ferrotantalite inclusions (2 by 2 by 3 mm). The mass popped out of topaz-bearing, quartz-megacrystic aplite material being prepared for bulk analysis. One side of the mass reveals crystal faces under the binocular microscope. The grain was in contact with muscovite, quartz and plagioclase and appears to be primary. Rock chips contain more oxides.

### MISCELLANEOUS PEGMATITE DIKES IN EASTERN BERYL ZONE

**94-1A**: Slab from a muscovite-garnet potassic pegmatite. Ragged remnants of light pink potassium feldspar are enveloped by garnet-muscovite plagioclase-rich replacement assemblage. Scant amounts of the following minerals occur in the albitized areas:

(a) unknown, soft brown mineral.
(b) black specks of possible columbite-tantalite.
(c) green specks of possible gahnite.
(d) partially weathered sulphides.

In all 4 samples only ferrocolumbite and garnet were found.

**94-1B**: Fragments from a relatively coarse (1 by 3 by 4.5 mm), platy black oxide crystal which is enclosed in a muscovite book (fragment also included). Could therefore be a primary oxide unrelated to the ensuing plagioclase replacement material, which hosts the finer grained black oxide specks. Only ferrocolumbite was found.

**94-2**: Pegmatite dike with mafic segregations similar to locality 93-249 in Separation Rapids pluton. Euhedral, 2 by 3 by 6 mm, black ferrocolumbite crystal, scattered in low amounts especially near mafic-rich segregations (possibly after cordierite). Similar to locality 93-249 in Separation Rapids pluton, these mica-rich domains contain euhedral beryl.

**94-49**: Specks of black oxide (ferrocolumbite) in a narrow, plagioclase-rich dike. The rust spots may be related to weathering of the black mineral that is likely a primary oxide mineral.

**94-57**: Biotite-garnet aplite unit from large dike of potassic pegmatite. Rock contains a scattered fine-grained, soft red-brown mineral (possibly hematite?) and rare gahnite. The areas circled in black contain tiny, black grains of possible columbite-tantalite. The columbite appear primary. No albitization can be seen. Electron microprobe analyses determined ferrocolumbite composition close to the ferrotantalite boundary.

## Eastern Petalite Zone

### PEGMATITE 1 (PETALITE ISLAND)

**94-34**: Garnet-muscovite aplite with a curious, locally colour-zoned (dark orange rims to green centre), unknown mineral (?monazite). Speck or two of glossy black ferrocolumbite present.

**94-34B**: Fragment of the largest ferrocolumbite crystal found in this pegmatite to date (2 by 3 by 4 mm). The mineral occurs at the contact of the pegmatite with mafic metavolcanic host rocks and specifically within a fine-grained, grey, 0.5 cm thick layer of probable plagioclase. The cross-section is roughly diamond-shaped, however, neither wodginite nor cassiterite was found with the electron microprobe. Nigerite present.

**94-34C**: Small slab piece from large block collected at the eastern limit of exposure. Large pieces reveal some lovely textural relations that may shed light upon petalite-spodumene relations with further study. Minute black ferrocolumbite occurs on cut surface (red circles) and a larger grain (1 by 2 mm - cassiterite?) also occurs.

### LOU'S PEGMATITE

**93-272A**: Green muscovite-quartz-plagioclase assemblage. A few minute needle-like grains of ferrocolumbite occur in quartz. Blue-black schörl tourmaline also present.

**93-272B**: Green muscovite-quartz-plagioclase assemblage. A 2 by 7 mm aggregate of cassiterite crystals lies in the quartz. In some parts of the hand specimen, slender muscovite clearly penetrates into plagioclase. Sample also contains garnet, stibiomicrolite, ferrocolumbite, ferrotantalite, wodginite, cassiterite and löllingite. Large euhedral zircon contains inclusions of probable xenotime.

**93-272D**: Small cut specimen contains pink garnet and a cluster of black oxide minerals (ferrocolumbite, ferrotantalite, ferrowodginite and stibiomicrolite) which contact a less abundant brown mineral with possible metamict alteration. Arsenopyrite present.

**93-272E**: Large cassiterite (with inclusions of antimonian microlite and ferrowodginite) at eastern end of pegmatite. Ferrocolumbite found in a second grain.

**93-272E**: Glossy black, platy euhedral oxides that occur as inclusions in plagioclase, quartz and light green beryl from east-end of pegmatite. Small fragments in plastic vial contain oxide inclusions within a plagioclase crystal in contact with beryl. Small cut piece contains a large euhedral cassiterite and on the reverse side several much smaller oxide grains. Cassiterite contains inclusions of ferrocolumbite, ferrowodginite and stibiomicrolite.

## MARKO'S PEGMATITE

**93-275C**: Petalite-quartz-muscovite-plagioclase assemblage that lies marginal to very coarse petalite-potassium feldspar zone. Hand specimen contains 3.2 by 4 cm splintery crystal of ?petalite or possibly secondary spodumene (mineral was not specifically X-rayed here). The coarse, dark mica books (lithian muscovite and lepidolite) exhibit a slight curvature, somewhat reminiscent of zinnwaldite. Cassiterite also present.

**93-275D**: From pod rich in lilac mica (lithian muscovite and lepidolite) and containing cassiterite and löllingite.

### Beryl-muscovite-plagioclase-quartz wall zone

**94-44I**: A black oxide grain, 2 by 4 mm, in primary plagioclase from beryl-muscovite-plagioclase-quartz wall zone. Actual contact with some adherence of biotite-rich metasomatic mafic metavolcanic material is included in sample. The grain is remarkable and characterized by patchy compositional variation that includes wodginite, ferrowodginite and ferrotitanowodginite. Also contains cassiterite, stibiomicrolite and strüverite.

**94-44J**: Black titanowodginite, ferrotitanowodginite and cassiterite found within a 12 by 12 mm area in beryl-muscovite-plagioclase-quartz wall zone. Stibiomicrolite and strüverite present too.

**94-44K**: Brown cassiterite, and black titanowodginite, ferrotitanowodginite, manganocolumbite and stibiomicrolite crystals from the wall zone. The same unit as 94-44I which produced the titanium-enriched wodginite analyses. The enclosed samples were cut from two blocks of material (bags numbered Block 1 and Block 2), which have been retained for any further work. Block 1 contains an unknown red-orange mineral cut out from one of the corners. Block 2 contains the rare wodginite species.

**94-44MU-5**: Fine, euhedral black manganocolumbite inclusions extracted from books of muscovite in wall zone at site MU-5. Monazite is present and partly occurs as smaller, yellow inclusions in some of the oxide crystals. The second vial is from same cluster of oxide inclusions in muscovite, but contain a greater amount of the yellow monazite.

### Layered pegmatite – fine-grained granite unit in contact with east end of petalite-rich core

**94-44N**: Black cassiterite with manganocolumbite from layered pegmatite-aplite unit. The dark layer contains an abundant, soft, khaki-weathering unknown mineral (possibly some type of phosphate), which is intergrown with dark mica and garnet. Fine oxides are abundant in adjacent plagioclase-rich assemblage (circled on specimen). Also an unknown light brown mineral is part of the assemblage—probably the cesium-rich mica, nanpingite. A second piece contains a fine needle-like dark mineral as inclusions in plagioclase and elsewhere seen in beryl.

**94-44W**: Slab surface across orange garnet-rich layer and adjacent muscovite-quartz-plagioclase host. A large, 8 by 22 mm mass of a hard black mineral occurs in the garnet-rich layer whereas much finer grained, euhedral, commonly platy oxides (manganocolumbite) sporadically occur in the host. The latter are associated with a slight reddening, which may relate to radioactive damage(?). Thorium-rich monazite is notable in this sample. The coarse black mineral contains a small inclusion of garnet and partially envelops euhedral garnet at one end. Cassiterite and manganotantalite also present.

### East end of Marko's Pegmatite

**94-44G**: Fine-grained, black manganocolumbite and cassiterite associated with abundant orange spessartine garnet within quartz-muscovite-pink plagioclase assemblage at eastern end of Marko's pegmatite. Near Champion Bear Resources diamond drill platform of early 1990s.

**94-44H**: Extreme eastern end of Marko's pegmatite. Vein rich in black oxides with garnet-pink plagioclase host. Local cleavelandite, apatite and blue green tourmaline about one metre away. Two samples examined by electron microprobe and only garnet found.

**94-44U**: Abundant platy to stubby manganocolumbite and cassiterite grains in a muscovite-quartz-plagioclase-orange garnet rock near the eastern end of Marko's pegmatite and specifically near old diamond drill platform (these may just be cassiterite). Some of the oxide grains occur as inclusions within the garnet. One small ferrowodginite grain also found.

**94-44Y**: Sample that exposes both contacts at eastern end of pegmatite. Note the high garnet concentration next to ironstone contact. Also some strange acicular minerals (ferrocolumbite and cassiterite) are notable on rough surface.

**94-44Z**: Fine-grained oxides (ferrotapiolite), in muscovite-cleavelandite-quartz assemblage from the east end of Marko's pegmatite. The assemblage, which looks primary with no sign of the cleavelandite involved in any replacement textures, resembles the muscovite-quartz-cleavelandite unit at Locality 93-265. A secondary, ochre-coloured mineral lies interstitially to the cleavelandite laths and represents altered microlite (confirmed by electron microprobe). No cassiterite found. Biotite + garnet metasomatic selvedges at this locality are the thickest developed for the entire pegmatite.

## BERYL-MUSCOVITE-PLAGIOCLASE REPLACEMENT UNIT THAT OVERPRINTS PETALITE-RICH CORE ZONE

**94-44A**: Manganotantalite intergrown with wodginite and a finer grained, green euhedral mineral (microlite). These occur in thin veins with mauve mica and plagioclase, typically <1.5 cm thick, hosted by large masses of petalite.

**94-44C**: 6 by 10 mm euhedral black cassiterite and manganotantalite associated with plagioclase-quartz-mica veinlet in altered petalite and near a mass of the quartz-muscovite-plagioclase replacement unit.

**94-44D**: Black oxides (manganocolumbite, manganotantalite, wodginite, microlite and cassiterite) in muscovite-plagioclase replacement unit. Elbaite tourmaline also present.

**94-44E**: A small platy oxide crystal from an aplite mass (E1) that is hosted by the muscovite-plagioclase replacement unit (E2). Manganocolumbite, manganotantalite, microlite (abundant in E2) and cassiterite present.

**94-44M**: Euhedral, 3 by 8 mm cassiterite crystals that are joined and hosted in a 2.5 by 4.5 cm splotch of plagioclase quartz-silver muscovite which is entirely hosted in petalite. In this case, the cassiterite is clearly secondary and relates to plagioclase alteration of the petalite core unit. A nearby 2 mm thick vein rich in white mica contains a 0.5 by 4 cm crystal of dark green tourmaline (quite possibly elbaite) and a single grain of pyrite. The plagioclase also contains subtle needle-like black mineral. No tourmaline found with electron microprobe, but ferrotitanowodginite present.

**94-44P**: Small sample from plagioclase-rich replacement unit. Abundant fine-grained, platy to equant, glossy black wodginite and a subordinate orange red unknown mineral, best seen on wetted surface using a binocular microscope. The euhedral oxides occur as inclusions in plagioclase and possibly beryl. Cassiterite and löllingite also found with electron microprobe.

**94-44R**: Euhedral, black cassiterite with manganotantalite, wodginite and large microlite crystals, abundantly present in a muscovite-plagioclase replacement unit. Microlite hosts large euhedral, zoned inclusions of zircon. Löllingite also found. Bulk analysis of rock registered 1% $Ta_2O_5$.

**94-44S**: Muscovite-plagioclase replacement unit with abundant black oxide (wodginite and cassiterite) grains.

**94-44V**: Another euhedral, black, composite grain of wodginite and microlite from muscovite-plagioclase replacement unit. The possibly same red-orange unknown mineral as in 94-44P also occurs in the hand specimen.

**94-44ii**: These oxide grains, present in two plastic vials, come from a loose sample of the muscovite-plagioclase replacement unit found downslope from the zone of highest oxide concentration at Marko's pegmatite, i.e., 94-44P, 94-44Q, 94-44R. Wodginite, microlite and cassiterite found.

**94-44iii**: Three plastic vials containing oxide minerals from large hand sample of muscovite-plagioclase replacement unit that contains a few corroded relics of petalite. Oxides are very abundant and occur as inclusions mainly in the plagioclase (Vial I) – all wodginite. The oxide crystal fragments in Vial II (wodginite and manganotantalite) originated as inclusions within a 0.5 by 2.8 cm apatite crystal. Oxide minerals were also noted in some of the euhedral white beryl and near the margins of former petalite crystals. A lovely white, partially clear, euhedral beryl crystal (4.5 cm diameter; 7.5 cm parallel to c-axis) occurs in sample. Greenish-yellow, soft alteration of petalite sent in for X-ray diffraction and scanning electron microscopy work. Also a splintery light yellow mineral which occurs in an irregular mass, 9 by 1 to 2 cm, sent in for X-ray diffraction and scanning electron microscopy work. This mass appears to overprint the end of one of the former petalite crystals. Vial III contains microlite as dark yellow-green, euhedral crystals, which for the first time, appear to co-exist with other phases that comprise the muscovite-plagioclase replacement unit. Other microlites have come from the Wall Unit (94-44J and 94-44K) or in thin veins which crosscut the petalite-rich Core Unit (94-44A). The sample gives a complete cross-section of a 3 mm wide crystal.

## Aplite unit associated with sugary, fine-grained replacement pods

**94-44T**: White beryl-muscovite aplite with minute black platy oxides (wodginite and microlite). Also a coarse rectangular-shaped oxide crystal (3 by 12 mm) reveals an interesting brown and black internal zonation.

## Detailed sampling of oxides from wall zone at Marko's pegmatite, as function of adjacent host-rock type and with variation in distance from external pegmatite contact

### 1. OXIDES ADJACENT TO MAFIC METAVOLCANIC HOST-ROCKS

**96AT-1**: 0.5 by 1.5 mm, rectangular, black grains in quartz and plagioclase with brown-green muscovite nearby. Situated at exact contact of wall zone with garnet-biotite-plagioclase-metasomatized mafic metavolcanic host rocks. Note that no oxide sample except 96AT-6 comes closer to the host rock contact than this one. Ferrocolumbite, manganocolumbite, microlite, stibiomicrolite and second world occurrence of stibiobetafite found in complex relationship with one another.

**96AT-3**: 3 by 7 mm brown-black euhedral cassiterite that contains ferrotitanowodginite and microlite inclusions. Mostly enclosed in plagioclase and partly in contact with quartz. Coarse muscovite is nearby. Located 30 cm from contact.

**96AT-4**: Euhedral to anhedral, black, cassiterite with microlite inclusions scattered through a plagioclase-rich mass and situated 66 cm from host-rock contact and 10 cm from inner contact of wall zone with highly altered part of the petalite-rich core.

**96AT-5**: Black cassiterite containing inclusions of manganotantalite, titanowodginite and microlite within internal contact zone between wall zone and petalite-rich core, 76 cm from host rock contact. Oxide appears to be associated with plagioclase-rich replacement veins within corroded petalite relics. The oxide is also associated with light orange, possible low albite. About 100 cm from mafic metavolcanic host rocks.

**96AT-6**: Black columbite grains scattered over 13 cm near contact of quartz-rich part of wall zone and metasomatized, mafic metavolcanic rocks. Size: 1 mm diameter to 3 by 4 mm. The sample comprises a single columbite crystal almost completely enclosed in garnet-biotite-plagioclase metasomatic selvedge material. Equally of ferrocolumbite and manganocolumbite composition and containing unique antimony- and uranium-rich microlite inclusions.

**96AT-7**: Cluster of ferrocolumbite grains in muscovite-plagioclase<<quartz wall zone situated about 1 cm from mafic metavolcanic contact and near 96AT-6. Grains have many microlite inclusions and a patchy zonation.

**96AT-8**: 0.5 by 1.5 cm euhedral, cassiterite with titanowodginite and ferrotitanowodginite inclusions all contained in plagioclase. Situated about 6 cm from contact of wall zone with petalite-rich core zone. In a separate polished thin section, manganocolumbite and manganotantalite also found.

### 2. OXIDES ADJACENT TO BANDED IRON FORMATION HOST-ROCKS

**96AT-9**: Coarse, black, euhedral ferrocolumbite situated 3.5 cm from a 7 by 36 cm foliated mafic metavolcanic enclave, which, in turn, is 15 cm from banded iron formation host rock. Ferrocolumbite mostly enclosed by plagioclase.

**96AT-10**: Several fine-grained, black, euhedral manganocolumbite crystals occurring as inclusions within a 3 by 5.5 cm beryl and situated 38 cm from host-rock contact. Monazite is common in this sample.

**96AT-11**: Two vials of oxide material:

A) Black, euhedral, 3 by 5 mm cassiterite containing ferrotitanowodginite and microlite inclusions with 7 crystal faces, almost completely enclosed by plagioclase. Situated 36 cm from host-rock contact.
B) Rectangular cassiterite (with one microlite inclusion), 5 by 9 mm, almost completely enveloped by plagioclase. Situated 40 cm from host-rock contact.

**96AT-12**: Euhedral, black cassiterite containing titanowodginite, ferrotitanowodginite and microlite inclusions, 1 by 3 mm and 3 by 5 mm, mainly in plagioclase, but locally touching quartz. Situated 112 cm from banded iron formation host rocks and 17 cm from contact with petalite core.

**96AT-13**: Black cassiterite (with inclusions of antimonian microlite) in contact with plagioclase and lesser quartz. Distance from host-rock contact was not recorded, but located in same general area as 96AT-12.

**96AT-15**: Loose piece of muscovite-plagioclase-quartz wall zone with abundant black oxides (cassiterite and microlite identified). Rare fluorapatite also present.

**96AT-16**: Yellow beryl, 26 cm from banded iron formation contact, occurring as 2 by 4 cm crystal and in contact with plagioclase, quartz and fine-grained muscovite. A piece of the beryl with a small black manganocolumbite inclusion included.

**96AT-17**: 7 by 10 mm cassiterite situated in wall zone 32 cm from banded iron formation host rocks and in part of pegmatite with the layered sodic pegmatite and/or grey aplite unit. Sample remarkable for containing euhedral, ferrotitanowodginite inclusions together with inclusions of ferrocolumbite, and microlite.

**96AT-19**: Extreme east-end of Marko's pegmatite.

A) Blue tourmaline (elbaite) from cleavelandite-quartz pod.

B) Quartz<<plagioclase unit with loads of altered garnet or oxide minerals. Wodginite is the main oxide present occurring as tabular, euhedral crystals and partially replaced by microlite. Manganotantalite also present.

**96AT-20**: Mass of black tourmaline (schörl – very different from tourmaline in 94-44D and 96-19A) situated 2 to 5 cm from banded iron formation contact.

## JAMES' PEGMATITE (ALSO CALLED PEGMATITE 4)

**93-276A**: Sheared, tourmaline(dark brown schörl)-apatite-muscovite-petalite pegmatite. The pegmatite elsewhere also contains cassiterite.

**93-276B**: Sheared tourmaline-apatite-muscovite pegmatite. Rock contains deformed masses of green apatite and odd orange spessartine garnet, wrapped by fine-grained mica and sparse, ferrowodginite, ferrotantalite and cassiterite. Also note yellow (?secondary) mineral (arsenopyrite). Ontario's first occurrence of a wodginite group mineral came from this sample.

**93-276C**: Small mass of cassiterite crystals in quartz-muscovite-plagioclase host. Core zone oxide mineralization occurs as clusters of coarse crystals (1 to 18 mm diameter) in a hematite-stained plagioclase-rich mass with apatite near a quartz-rich mass.

**93-276D**: Cluster of brown-black cassiterite in a mass of hematite-stained plagioclase situated in the pegmatite centre and proximal to an elongate quartz-rich mass (10 to 20 cm by 1.5 m). The cassiterite is entirely enveloped by plagioclase and is 1 to 18 mm in diameter. Apatite is also present in the plagioclase-rich mass.

**93-276E**: Platy black cassiterite, 1 mm or less in thickness, which occur in plagioclase associated with very abundant apatite (40% in a 10 by 10 cm area). Muscovite books lie in contact with the apatite-plagioclase assemblage. Oxide minerals were not seen within the apatite grains.

**93-276F**: Abundant brown cassiterite in a pink plagioclase-rich pod near the north contact. This pod is 15 by 60 cm and oriented normal to the northern contact.

## PEGMATITE 5

**94-80A**: A 2 by 5 mm black cassiterite crystal which occurs in an apatite-tourmaline (schörl)-muscovite-quartz-plagioclase assemblage near the northern contact. The oxide is 1 cm from the contact.

**94-80B**: Twinned, euhedral brown-black cassiterite with striations. Mineral broke along twin plane during removal. Approximately square, 7 mm in diameter and entirely enclosed in plagioclase in a muscovite-biotite-petalite-potassium feldspar-plagioclase (local beryl) assemblage near the north contact.

**94-80C**: Fine-grained cassiterite 55 cm from 94-80B and in same assemblage. Occurs in 3 cm diameter quartz which is surrounded by plagioclase.

**94-80D**: Small grains of black ferrowodginite with uranmicrolite inclusions in a <1 cm thick vein with the largest mass of petalite. Vein mainly consists of plagioclase with minor garnet and tourmaline.

**94-80E**: A second sample from the herringbone, apatite-plagioclase intergrowth contained in the ballpeen muscovite-quartz unit that contains more fine-grained black oxides and near the same site as for previously analyzed high-$WO_3$ oxides, i.e., completely enclosed in apatite or lying along contact between apatite and pink plagioclase. Only cassiterite found by electron microprobe. Note: 94-80N below, contains oxides from an identical apatite-plagioclase intergrowth, but in a different specimen.

**94-80F**: A cut specimen with a 2 by 3 mm section of a black oxide within pink potassium feldspar (but perhaps connected to albitized petalite below surface) near its contact with quartz. On the reverse cut surface, a series of small black oxide grains occur in similar fashion. Wodginite with up to 3 wt % $WO_3$ present. Cassiterite also present.

**94-80G**: Several pieces from a biotite-muscovite-potassium feldspar-quartz-plagioclase assemblage with large scattered petalite megacrysts. The recrystallized petalite is locally replaced by veins rich in plagioclase (lesser silver muscovite, quartz, apatite and garnet). Several small black wodginite grains have been circled in pink. Largest oxide is a euhedral crystal at 1 by 1.5 mm. Electron microprobe reveals wodginite with up to 2.9 wt % $WO_3$.

**94-80i**: Slabs from a garnet-white beryl-apatite-black tourmaline - ballpeen-texture muscovite-quartz-pink plagioclase assemblage from south contact of pegmatite and a few metres from 94-80E. Numerous grains of fine-grained black oxides tend to be more common within 3 cm of the mafic metavolcanic rock contact. A faint red hue may be due to radioactive related alteration. Ferrotantalite, cassiterite and microlite found with electron microprobe.

**94-80J**: Abundant black ferrowodginite in a second plagioclase-rich vein that cuts across a large recrystallized petalite megacryst. Lies about 10 cm from the vein that hosts wodginite in 94-80D.

**94-80K**: Two black ferrowodginite grains, about 1.5 mm diameter, in muscovite-quartz-plagioclase vein in petalite megacryst.

**94-80L**: Abundant black ferrowodginite grains from a piece of a 2 by 3 cm ovoid alteration pod in a petalite megacryst.

**94-80N**: A second block from same unit that hosts the high $WO_3$ wodginite of 94-80E. Fragments of fine-grained, black, possible oxides in a plagioclase-apatite intergrowth next to a large curved book of silver muscovite (ballpeen texture) are enclosed in vial. Oxides from quartz in contact with plagioclase-apatite are included in vial. The plagioclase-apatite domains here occur as veins that emanate from larger ovoid masses that have the distinctive herringbone texture. Locally, the plagioclase-apatite assemblage with the oxides seems to locally replace the outer parts of the curved muscovite books and plagioclase crystals are found within the books as well. The oxides are possibly of replacement origin.

**94-80P**: Several black oxide specks situated along the margins of a mass of pink potassium feldspar and lesser petalite. The white mass of muscovite-quartz<<plagioclase with the oxides looks to be a product of albitization of the potassium feldspar and petalite. The deep red-brown mass is weathered purpurite. Oxides include ferrowodginite, wodginite with up to 12.3 wt % $WO_3$ and cassiterite (which rims the wodginite in places). One ferrotapiolite analysis was also obtained in a grain associated with ferrowodginite.

**96-AT23**: Cassiterite containing large inclusions of $WO_3$-rich ferrowodginite from the fluorapatite-light pink plagioclase intergrowth in Pegmatite 5. Exactly the same site as sample 94-80E. Sample has a maximum value of 25.4 wt % $WO_3$ and averages 15.8 wt % $WO_3$ based on electron microprobe analysis.

## PEGMATITE 6

**94-90A**: Garnet-beryl-muscovite-tourmaline pegmatite with a red mineral locally along subtle shear surfaces (possible some secondary uranium-thorium-bearing phase). The smaller sample contains black ferrowodginite and cassiterite grains.

**94-90B**: Several small oxide grains plucked from plagioclase-rich veins that replace parts of a large petalite mass. These veins also contain sparse quartz, garnet and local clusters of black tourmaline and biotite. The plagioclase veins definitely cut the delicate, fine-grained intergrowths of quartz and spodumene in the petalite. Some of the fine-grained black grains could actually turn out as tourmaline (none found). The setting for these oxides is similar to 94-80E and 94-P7E and indicated by ferrowodginite with up to 26.3 wt % $WO_3$. Cassiterite also present.

**96-AT21A**: Coarse black euhedral cassiterite in biotite-muscovite-potassium feldspar-quartz-plagioclase unit (with local black tourmaline, green beryl and petalite). The cassiterite is a 3 to 10 mm by 17 mm crystal almost entirely in contact with plagioclase.

**96-AT21B**: Cluster of black tourmaline (schörl) in quartz and plagioclase. The tourmaline looks primary and in same unit a 96-AT21A.

**96-AT22**: Tourmaline (schörl) porphyroblast that overprints petalite.

## PEGMATITE 7

**94-Peg7A**: Several oxide crystals (cassiterite) in a quartz-muscovite-apatite-plagioclase assemblage in the western, plagioclase-rich part of pegmatite. Euhedral cassiterite occurs in plagioclase and also apatite.

**94-Peg7B**: Several coarse oxide crystals in plagioclase-rich material next to southern contact. Includes ferrocolumbite, ferrotantalite, wodginite, cassiterite and microlite. Arsenopyrite and very rare scheelite also found.

**94-Peg7C**: Black and brown cassiterite. Also note the slightly recessive brown mineral and some apatite. Otherwise, the oxides are largely enveloped by plagioclase.

**94-Peg7D**: Two cassiterite crystals from a 10 cm wide, plagioclase-rich border unit adjacent to thin reentrants of mafic metavolcanic rock. A 10 cm by 1 m, quartz-rich pod (quartz-beryl-tourmaline-muscovite) lies about 10 cm from the oxide-rich mineral cluster.

**94-Peg7E**: Small black wodginite grains from plagioclase-rich replacement patches within a recrystallized, 3.7 m long petalite crystal. This is an identical habitat to the tungsten-rich wodginite at Pegmatite 5 (94-80E). Ferrowodginite contains up to 10 wt % $WO_3$ in this sample.

**94-Peg7F**: Fragments from a 1 by 3 cm rectangular grain of löllingite in the tourmaline-muscovite-quartz<<plagioclase unit at west end of pegmatite.

**94-Peg7X**: Oxide-rich (cassiterite, ferrowodginite and microlite) sample – in a matrix of mainly potassium feldspar and apatite. Cut surface indicates sample came from edge of channel cut near where large crystal was removed. Vial 1 contains several small wodginite grains. Vial 2 contains a single black oxide fragment from a second vein of muscovite-plagioclase situated about 6 cm from that in Vial 1.

**97-P7-1**: Several black, oxide grains (ferrotantalite, wodginite and cassiterite) hosted in a vein-like mass rich in plagioclase that replaces a deformed and highly recrystallized petalite megacryst.

## PEGMATITE 9

**94-318**: Various pieces from a large hand specimen of highly sheared garnet-muscovite-potassium feldspar-quartz-plagioclase pegmatite. Many small black specks occur which identify as ferrocolumbite, ferrotantalite, cassiterite and less commonly ferrowodginite. Nigerite also present.

## PEGMATITE 10

**97-P10-1**: Garnet-muscovite-potassium feldspar-quartz-plagioclase rock, quite deformed and with host rock contact exposed along one edge of sample. Several clusters of fine-grained oxide minerals (ferrocolumbite, ferrotantalite, ferrotapiolite, ferrowodginite, cassiterite and nigerite) are notable.

**97-P10-2**: Muscovite-quartz-plagioclase-(garnet) rock with scant, fine-grained, oxide minerals (ferrocolumbite, ferrotantalite and cassiterite).

**97-P10-3**: Similar material to 97-P10-1 with platy black oxide grains (ferrocolumbite, ferrotantalite, ferrowodginite, cassiterite and nigerite) up to 0.75 by 2 mm.

**97-P10-4**: Similar rock to 97-P10-1, but richer in potassium feldspar. Black oxide grains (ferrocolumbite, ferrotantalite, ferrotapiolite, cassiterite and nigerite) are relatively abundant, but generally fine grained.

**97-P10-5**: Small sample and similar to 97-P10-1, but with coarsest, black oxide grains (ferrocolumbite, cassiterite and nigerite) seen in pegmatite.

## PEGMATITE 11

**95-117A**: Garnet aplite unit that contains patches of deformed petalite. Several euhedral grains of an unknown, hard, platy, orange brown mineral (about 0.1 to 1 mm diameter) is possibly nigerite. The tantalum oxide mineral is mainly manganocolumbite, although rare strüverite is present.

**95-117B**: Specks of black ferrocolumbite and cassiterite found (black tourmaline is also common in Pegmatite 11). This material is from the same garnet aplite that contains 95-117A.

**95-117C**: Small hand specimen showing largely recrystallized, fine-grained petalite masses (brown stained mineral) which is variably overgrown by white, metasomatic plagioclase and odd black tourmaline (schörl). The circled area contains a 1 mm diameter platelet of possible nigerite which is mainly hosted by plagioclase. Ferrocolumbite and ferrotantalite are accompanied by strüverite.

**95-117D**: Small, dark brown, cassiterite grains hosted in a muscovite-garnet-biotite-quartz-plagioclase rock (possibly some sort of aplite). Black tourmaline (schörl) also present.

## MISCELLANEOUS PEGMATITE DIKES IN EASTERN PETALITE ZONE

**93-355**: Specimen from a quartz-rich, small dike that occurs in the petalite zone, 50 m east of Lou's pegmatite. Consists of pink garnet, biotite, muscovite, faint blue cordierite and abundant quartz. A deep yellow, unknown mineral also present (1 to 2%). A sparse, elongate, glossy black oxide mineral was revealed by electron microprobe work to be ferrocolumbite with very primitive composition ($Ta_2O_5$ = 6.6 wt %).

# SOUTHWESTERN PEGMATITE SUBGROUP

## Southwest Beryl Zone

**94-15A**: A 3 m thick, garnet aplite-pegmatite dike in mafic metavolcanic rocks near the contact of the Separation Rapids pluton at locality 93-260. Many small black oxide grains (ferrocolumbite, ferrowodginite and cassiterite) are obvious in a sample of the dike margin that comprises a biotite-quartz-plagioclase assemblage. Largest oxide grain is about 4 mm long.

**94-15B**: Dike margin material similar to 94-15A

**96-9**: Numerous black oxide specks up to 1 mm diameter in 30 cm-thick albitite dike. Mainly ferrotapiolite, but manganotantalite, microlite and strüverite also present.

**96-11**: 1 m thick dike of biotite-garnet-muscovite aplite and/or pegmatite (local beryl in pegmatite part). Two samples examined:

**96-11A**: Sparse black specks of ferrocolumbite and cassiterite (with one tiny ferrotapiolite? inclusion) occur in the garnet-quartz-plagioclase unit.

**96-11B**: Silver-grey arsenopyrite from biotite-garnet-muscovite, aplite and/or pegmatite dike. Local beryl present.

**96-24**: Platy black oxides from a 0.7 by 1 m, quartz-muscovite-cleavelandite pod (looks similar to the cleavelandite pods at 93-260) in 30 to 40 m thick dike of biotite-muscovite potassic pegmatite. Oxides up to 1 by 5 mm shown to be oscillatory zoned manganocolumbite.

**96-25**: A second large pegmatite dike very close to 96-24. Main rock type is biotite-garnet-muscovite-quartz-plagioclase pegmatite (probably some sort of sodic pegmatite). North contact with amphibolite reveals sporadic platy black oxides up to 2 by 5 mm which are associated with blue-green beryl.

**96-25A**: Platy cassiterite (with microlite inclusions) in pegmatite, but only 1 cm away from biotite-rich metasomatic selvedge developed on amphibolite host-rocks.

**96-25B**: Platy cassiterite situated in pegmatite and 4 cm from metasomatic selvedge.

**96-27**: 40 cm thick, garnet aplite dike situated a short distance from north contact of Big Whopper petalite pegmatite and possibly part of its mineralized system. Aplite contains numerous fine specks of black cassiterite.

**96-53**: 1 m thick dike of quartz-megacrystic, biotite-muscovite-garnet aplite. Sparse milky beryl also occurs.

**96-53A**: Garnet-beryl-biotite-quartz-plagioclase rock with several deep brown, euhedral cassiterite crystals. 96-53A and 96x53A are two separate crystals, the latter containing ferrotantalite and ferrotapiolite inclusions. A 1.3 by 1.7 cm light green crystal of beryl occurs in the small specimen.

**96-53B**: Coarse-grained, garnet-muscovite-quartz-plagioclase sample taken from the central part of dike. Fine-grained, sparse black cassiterite and patchy zoned, intergrowth of ferrocolumbite and ferrotantalite.

**96-55**: Dike of garnet-muscovite potassic pegmatite layered with garnet-muscovite aplite. The aplite contains locally abundant black ferrocolumbite and sparse milky beryl. Some of the oxides appear to be cassiterite (none found with electron microprobe). Thorium-rich monazite also noted.

**96-59**: Narrow deformed aplite dike evident as 30 cm thick boudins. Sparse oxides, possibly cassiterite in part, are present. Also a fine-grained, earthy red-brown mineral is evident and could be monazite. Only garnet was analyzed with electron microprobe, although many totally altered oxides were encountered.

**96-76**: Sparse black cassiterite and ferrocolumbite specks in a 30 cm thick dike of coarse-grained, quartz-plagioclase rock that also contains sugary aplite. Most of the oxide specks found in the sugary aplite. Dike occurs in amphibolite near south contact of Separation Rapids pluton. An earthy red-brown mineral may be monazite.

**96-76A**: A further sample to that previously analyzed. A number of fine black oxide specks are noted and also a metamict, grubby brown to green phase is present and confirmed by electron microprobe as zircon. Ferrocolumbite is the main oxide phase and is accompanied by cassiterite with high tantalum content (9 wt % $Ta_2O_5$).

**96-81**: Dike of deformed, quartz-megacrystic, garnet-chlorite-biotite-plagioclase pegmatite, up to 0.6 m thick. Contains numerous specks of fine-grained black oxides. The metasomatic selvedge along this dike has unusually high cesium (5000 ppm Cs). Ferrotapiolite is the main oxide present: earlier, patchy zoned ferrotantalite is associated with it. Cassiterite also present in minor amounts.

**96-81X**: Duplicate sample contains much less ferrotantalite and ferrotapiolite than above material.

**96-85**: Scattered black ferrocolumbite and cassiterite (with inclusions), 1 by 1 mm to 2 by 3 mm, circled, from a coarse-grained to pegmatitic, garnet-muscovite granite dike (2 m thick). The dike intrudes foliated mafic metavolcanic rocks just outside of the Separation Rapids pluton and across the bay from 93-260.

## Locality 96-86: Small pegmatitic granite pluton in SW Beryl zone

**96-86**: Muscovite-garnet aplite with several brown and black oxide grains, several of which appear to be cassiterite. Material from this locality may have been previously analyzed by electron microprobe, but came from a cleavelandite-rich unit. The locality is situated in the western part of the beryl zone and is 100 m north of the petalite-bearing, West pegmatite. Notable zircon in this sample. Most oxide is cassiterite, but ferrocolumbite and ferrotantalite occur as inclusions in garnet. Nigerite present too.

**96-86A**: Apatite-muscovite-quartz-cleavelandite pod with scattered possible oxide minerals contained in a large ovoid-shaped mass, 250 by 300 m, mainly composed of pegmatitic leucogranite and potassic pegmatite with minor aplite and quartz-rich pods. The vial contains fragments of very thin, platy black oxides (manganocolumbite that is patchily replaced with manganotantalite) and the arrows on the larger piece point to a more equant, black mineral with a reddish tinge.

**96-86B**: Dark brown, euhedral ferrocolumbite (zoned to a manganotantalite rim) in plates about 1 mm thick and at least 3 by 7 mm in the other dimensions, from a quartz-rich pod which also contains plagioclase, blocky potassium feldspar and muscovite books (latter two minerals analyzed at the Ontario Geological Survey Geoscience Laboratories). Also some cassiterite associated with the ferrocolumbite.

**97-10A**: Garnet-muscovite aplite dike, about 1 m thick, with several black oxide grains (manganotantalite) and scarce fine-grained yellow green mineral (chrysoberyl).

**97-16A and 97-16B**: Material from aplite dikes, 3 cm to 1.5 m thick, hosted in amphibolite very close to contact with Separation Rapids pluton. The two aplite samples contain fine-grained, black and dark green oxide minerals (cassiterite, ferrocolumbite and ferrotantalite). Some garnet also present.

**97-69**: Two small pieces of glossy-black, non-magnetic, oxide mineral separates (cassiterite, and ferrowodginite + lesser ferrotapiolite) chipped out of a deformed, 1m thick aplite dike.

**97-134A**: Garnet-biotite-muscovite-potassium feldspar aplite dike, 20 to 30 cm thick, which contains several black oxide grains (ferrocolumbite and cassiterite).

**6056**: Muscovite-lepidolite-polylithionite-bearing, sodic pegmatite. A fairly evolved rock as indicated by rubidium and cesium contents of mica and potassium feldspar. Several black and green grains of oxide minerals as detailed below:

**6056A**: Gahnite crystal, about 45 by 6 mm, intergrown partially with muscovite, but mainly hosted in quartz. Ferrocolumbite also present.

**6056B**: Two pieces represent a single crystal of a peculiar, charcoal-black, 2 by 10 mm, oxide minerals (ferrocolumbite and ferrotantalite with minor microlite).

**6067A**: Garnet-biotite-quartz-plagioclase rock containing a few crystals of dark brown ferrocolumbite and ferrowodginite.

**6081 and 99AT-6081**: Cordierite-biotite-garnet-quartz-potassium feldspar-plagioclase dike, 2 to 3 m thick, situated 25 m north of the Zone 11 petalite pegmatites. One area along the south contact of the dike contains abundant, conspicuous, coarse-grained, black cassiterite up to 7 mm diameter. Cassiterite contains ferrocolumbite and rare microlite inclusions. Holmquistite present as fine needles associated with the cordierite. Also sampled by Steve Smith (99-SS158).

**6090:** Biotite-garnet-quartz-plagioclase dike, 2 to 3 m thick, situated 170 m north of Big Mack pegmatite. Rock contains fine-grained black specks of ferrocolumbite.

# Southwestern Petalite Zone

## PEGMATITE 12

**96-13B**: Sample of fine-grained aplite and deformed, recrystallized petalite-rich material next to host-rock contact. Fine black specks of oxides put in plastic vial, some of which occur in rock chips. Cassiterite present with a single manganocolumbite inclusion.

## BIG WHOPPER PEGMATITE

**96-29A**: Sparse, fine-grained, black cassiterite, manganocolumbite and manganotantalite grains in a 1.3 m thick, muscovite-quartz-plagioclase dike related to the Big Whopper pegmatite. Appreciable acicular apatite noted in thin section.

**96-29B**: Sparse, fine-grained, black oxides in a biotite-quartz-plagioclase dike, 2 m thick, and situated 10 m west of 96-29A. Dike also likely related to Big Whopper. Patchy zoned ferrotantalite and manganotantalite grains together with cassiterite found.

**96-29C**: Sample richest in oxides and from a purple mica-quartz-plagioclase dike very near Big Whopper pegmatite contact. Dike is about 1 m thick and locally rich in purple mica. Oxides range from, <1 mm to 5 by 8 mm, the largest oxide is cassiterite. Manganocolumbite and manganotantalite present too as individual crystals.

**96-29D**: Black cassiterite (with rare ferrocolumbite and manganotantalite inclusions) specks in garnet-quartz-plagioclase rock from same dike as 96-29A. One euhedral oxide shows double wedge-shaped outline.

**96-29F**: Piece from the main petalite zone of the Big Whopper pegmatite. Oxides are in general difficult to find in the petalite-rich unit. This piece has a couple of black manganocolumbite specks in a muscovite-garnet-quartz-potassium feldspar assemblage. The oxide specks appear to be associated with incipient albitization as these lie in contact with delicate plagioclase-rich veins. Two separates from this sample proved to be garnet.

**96-29G**: A few black oxide specks in a specimen of deformed petalite pegmatite. The oxides appear to relate to patches of plagioclase-rich material. Only sample to date that contains yttropyrochlore and yttrian microlite. Ferrocolumbite, ferrotantalite, manganocolumbite, cassiterite and nigerite are also present.

**96-31**: Dike composed of aplite (3 m thick) and pegmatite that could represent western end of the Big Whopper pegmatite. The margins consist of a garnet-muscovite aplite with common, <1 to 3 mm diameter black oxide specks, most of which are cassiterite. Ferrocolumbite also present. The aplite grades into a pegmatitic centre marked by abundant potassium feldspar, but no petalite.

**97-185A**: Garnet-biotite sodic pegmatite, vaguely foliated, inequigranular adjacent to northern contact of Big Whopper pegmatite. Possible eucryptite as a greasy green spot also noted. Monazite and primitive, low $Ta_2O_5$ ferrocolumbite (average 13 wt %) present.

**97-185B**: Garnet-biotite aplite that grades into 97-185A. Sparse megacrysts, up to 2.5 cm diameter, of a green phase could be eucryptite and occur in a 2 cm thick, petalite-rich layer. Manganocolumbite and manganotantalite present.

**97-186**: Albite-quartz-potassium feldspar aplite that was divided for electron microprobe analysis:
  **97-186X**: aplite with some large garnets and a little cassiterite
  **97-186Z**: aplite with more abundant cassiterite than 97-186X and lesser garnet.

### Cassiterite data also collected on 97-186vii and 97-186B

**97-186A**: Garnet-muscovite aplite that lies in contact with a mafic metavolcanic enclave. Part of an altered greasy green megacryst is apparent and likely represents eucryptite. Several fine-grained black specks of oxide minerals (ferrocolumbite, ferrotantalite and cassiterite) also noted.

**97-186C**: Potassium feldspar-megacrystic, garnet-muscovite aplite. Loose piece from northern end of trench. Several black oxide grains notable (ferrocolumbite, cassiterite and lesser manganocolumbite). Nigerite also present.

**97-198**: Loose piece of aplite from northern part of trench. A 5 mm diameter gahnite crystal is obvious and the coarsest seen in the Big Whopper pegmatite. A few black oxide specks present (manganocolumbite, manganotantalite and cassiterite).

**97BW-1**: Muscovite-petalite-plagioclase unit near southern end of trench. Contains manganocolumbite and manganotantalite.

**97BW-2**: Piece of layered rock with fine-grained muscovite aplite and coarser, muscovite-potassium feldspar-petalite units from northern part of trench. Glossy black elongate and equant oxide minerals (manganocolumbite, manganotantalite and cassiterite) appear to be mainly hosted by the aplite unit. Thorite also present.

**97BW-3**: Purple mica-quartz-plagioclase unit that is similar to 96-29C. Black possible oxide mineral noted in several parts of sample.

**97BW-4**: Petalite-rich sample with specks of green gahnite and dark brown cassiterite, manganocolumbite and manganotantalite (some with relatively high $UO_2$ contents). Sample represents a loose blast piece near southern pegmatite contact in trench.

**97BW-5**: Quartz-plagioclase rock from trench with several specks of oxide minerals which appear mainly to be cassiterite. Ferrocolumbite and garnet also present.

**97-BW6**: Aplite unit that has banded appearance due to thin layers rich in pink petalite. The sample originated from the trench about 20 m from north contact. Several fine-grained dark grains occur especially in the aplite part and were indicated by electron microprobe to be cassiterite.

**97BW-7**: Symmetric-zoned petalite dike emplaced in large mafic metavolcanic enclave which is intersected midway along the trench. The two internal zones were sampled as detailed below:

**97BW-7A**: outer 2 cm thick, fine-grained, plagioclase-rich rims contains ferrotantalite, wodginite, ferrowodginite and microlite.

**97BW-7B**: inner, quartz-potassium feldspar<<petalite core zone that contains relatively abundant dark brown oxide grains mostly of cassiterite. Ferrocolumbite, ferrotantalite, wodginite, and microlite also present. Maximum size of grains: 5 by 6 mm.

**97BW-8**: Small pieces of aplite from midway along trench and just south of last mafic metavolcanic enclave in traversing from the north. Small specks of manganocolumbite and manganotantalite occur sparsely amongst more common cassiterite.

**98ATBW-1**: Sample of pegmatite unit with large pink petalite crystals and situated about midway along trench. Garnet, manganocolumbite and cassiterite also present.

**98SS-27**: Blue topaz-lepidolite-plagioclase rock from zone newly excavated by Avalon Ventures Ltd. Sparse manganotantalite, cassiterite and microlite also present.

**98SS-29**: Sample that contains fine-grained, plagioclase-rich border of Big Whopper and adjacent biotite-rich, metasomatized mafic metavolcanic rocks from a large enclave within the pegmatite mass. Sparse, fine-grained black oxide grains (ferrocolumbite, ferrotantalite, manganocolumbite, manganotantalite, wodginite, microlite and cassiterite) present in pegmatite part of sample.

## Drill core samples from Big Whopper pegmatite

**DC97-6-26**: Purple mica-petalite-plagioclase-potassium feldspar assemblage (unit 6D of Avalon Ventures Ltd.). One light pink square crystal is likely beryl; sparse black oxide specks also present (manganocolumbite and manganotantalite). From Hole 97-6 at 26.2 m depth.

**DC97-7-55**: Quartz-purple mica-petalite unit with traces of blue-green gahnite, cassiterite and minor microlite (Unit 6D of Avalon Ventures Ltd.). From Hole 97-7 at 55.9 m depth.

**DC97-8-57**: Muscovite-quartz-plagioclase-potassium feldspar assemblage (unit 4 of Avalon Ventures Ltd.). Several black oxide specks noted (ferrocolumbite). From Hole 97-8 at 57.1 m.

**DC97-8-91**: Garnet-petalite-muscovite-plagioclase assemblage (unit 4 of Avalon Ventures Ltd.). Black oxide minerals are rare (manganocolumbite and cassiterite). From Hole 97-8 at 91 m.

**DC97-8-124**: Finely banded, petalite-plagioclase-potassium feldspar assemblage. Black oxide minerals present (manganocolumbite and cassiterite). From Hole 97-8 at 124.8m.

## PEGMATITES 14 AND 15

**96-57**: Outcrop contains two highly deformed and identical petalite pegmatite dikes, both about 1.5 m thick and similar to locality 96-13. Also a related plagioclase-rich dike occurs a few metres south of Pegmatite 15, which was not sampled. Pegmatite 14 is represented by 96-57A, 96-57B and 96-57C, below:

**96-57A**: Specks of black cassiterite sparsely disseminated in a petalite-plagioclase-purple mica unit.

**96-57B**: Sparse, fine-grained specks of black cassiterite and ferrocolumbite in a garnet-quartz-plagioclase dike (possibly an albitite) situated near Pegmatite 15. Thin section has an amazing myrmekitic texture. A trace of holmquistite occurs on the outer contact of the dike with biotite-rich metasomatized amphibolite. Rock chip with a single fine-grained oxide in plastic vial is situated within 1 mm of the holmquistite-bearing, metasomatized amphibolite.

**96-57C**: Mass of recrystallized, light brown petalite overprinted locally by garnet and white feldspar (difficult to visually determine whether potassium feldspar or plagioclase). Specks of black and dark brown cassiterite, up to 1 mm, are mostly associated with the white feldspar-quartz-garnet-muscovite domains which possibly reflects albitization.

## GREAT WHITE NORTH PEGMATITE

**96-87**: Oxide specks in the aplite part of white petalite-bearing pegmatite discovered by Bob Fairservice and Jim Willis. These specks appear to be of two different minerals: the glossy, less common specks are possibly cassiterite and the second mineral is splintery and dark brown. Only large cassiterite confirmed with electron microprobe.

**97GWN-1**: Pieces cut from two exfoliated slabs at the west end of the pegmatite and consists of garnet-muscovite aplite with white potassium feldspar megacrysts up to 3 cm diameter. This rock is the dominant unit in this part of the pegmatite. Sparse green gahnite specks are present together with ferrocolumbite.

**97GWN-2**: Garnet-quartz-plagioclase rocks that forms a distinct, 30 cm thick, wall zone. Several black oxide specks apparent (manganocolumbite, manganotantalite and cassiterite).

**97GWN-3**: Garnet-quartz-potassium feldspar-plagioclase rock that is a loose piece from the north side of the pegmatite dike. The sample resembles border zone material of 97GWN-2 except for higher quartz and presence of potassium feldspar. Ferrocolumbite, cassiterite and nigerite found with electron microprobe.

**97GWN-4**: Loose piece from the petalite zone that also contains the odd gahnite grain up to 2 by 3 mm. Oxides include manganocolumbite, manganotantalite and cassiterite.

**97GWN-5**: Two pieces of petalite-bearing material selected from trench. A few odd black speck of oxide minerals are present (manganocolumbite, manganotantalite, wodginite and cassiterite).

**97GWN-6**: Garnet-quartz-plagioclase border zone material adjacent to biotite-rich, metasomatized mafic metavolcanic host rocks. Several black oxide grains up to 2 mm length present (ferrocolumbite, ferrotantalite and cassiterite).

## SCHOOL OF FISH PEGMATITE SWARM

**97-1**: Narrow, zoned, white dike with petalite and lesser, light green spodumene that is situated between the main School of Fish swarm and Bob's pegmatite. Abundant brown oxide minerals present, especially in plagioclase-rich patches that partially envelop coarse white potassium feldspar. The oxides appear mostly cassiterite, but ferrocolumbite, ferrotantalite and manganocolumbite also found.

**97-70**: Pegmatite 16 (largest dike in swarm and 0.7 m thick). Petalite-rich pegmatite chips taken next to a channel sample across the dike. Many fine-grained black oxide grains are noted (ferrocolumbite, manganocolumbite and cassiterite).

**97-71**: Narrow petalite pegmatite dike (5 cm thick) situated at the northern limit of the School of Fish dike swarm. The sample contains numerous black specks of oxide minerals (ferrotapiolite and microlite).

**97-264**: Cut pieces from a large specimen of a zoned dike composed of a petalite-rich core and plagioclase-rich rims. Several fine-grained oxide specks (ferrotantalite, microlite and cassiterite) occur in the plagioclase-rich rims. Nigerite also present.

## BOB'S PEGMATITE

**97BP-1**: Loose piece from trench of the garnet-muscovite-quartz-potassium feldspar unit. One grain of an unknown black mineral is circled. Manganocolumbite, manganotantalite and cassiterite found with electron microprobe.

**97BP-2**: Similar rock to 97BP-1 and also with one oxide grain (manganocolumbite and cassiterite).

**97BP-3**: Foliated, aplite rock with several black specks and an unknown yellow-green mineral that could be chrysoberyl. Also a layer, concordant to foliation, consists of a faint green, fibrous mineral that could be spodumene. Garnet, cassiterite and manganocolumbite also present.

## SWAMP PEGMATITE

**97SP-1**: Polished slab from the mylonitic, petalite-rich unit. Petalite grains have been ground to oblivion! Purple lepidolite mica, manganocolumbite, manganotantalite and cassiterite also locally present.

## WEST PEGMATITE

**97WP-1**: Biotite-garnet-quartz-potassium feldspar-plagioclase rock from the trench. Sample contains relatively abundant dark brown oxide grains (cassiterite and ferrocolumbite). Rare nigerite and pyrite also noted.

**97WP-2**: Similar unit to 97WP-1, but with coarse potassium feldspar megacrysts and much scarcer oxide grains (ferrocolumbite, ferrotantalite and wodginite).

**97WP-3**: Several loose pieces from trench each with visible oxide grains (manganocolumbite and cassiterite). Nigerite also present.

## BIG MACK PEGMATITE SYSTEM

**98-83C**: Garnet-muscovite-quartz-plagioclase rock from 10 to 15 cm thick wall zone of Big Mack pegmatite. Several partially to completely altered cordierite crystals, up to 2 to 4 by 9 mm, and fine-grained black specks of oxide minerals also notable (ferrocolumbite, ferrotantalite, cassiterite, strüverite and rare wodginite).

**98-83D**: Plagioclase-rich rim, 2 to 3 cm thick, developed continuously around an amphibolite enclave in the centre of the Big Mack pegmatite and probably due to albitization. Several fine-grained, black specks occur in the plagioclase-rich rims. In contrast, one black oxide speck occurs in the nearby petalite-rich unit (ferrotantalite). Gahnite also present.

**98-83E**: Black specks of oxide minerals (ferrocolumbite, ferrotantalite and cassiterite) from a plagioclase-rich replacement patch near the northern contact of the Big Mack pegmatite. Sample occurs near a spot where eucryptite was first identified although this mineral appears unrelated to the replacement unit. Nigerite also present.

**98-83F**: Fragments of a single, black, ferrotapiolite grain selected from the contact between fine-grained aplite (looks primary) and coarser grained, petalite-rich pegmatite. Sample is situated midway across the pegmatite towards its eastern end.

**98-83G**: Plagioclase-rich unit adjacent to contact with mafic metavolcanic rocks. A few black oxide grains (cassiterite and rare ferrotantalite) up to 1 by 1.5 mm are present.

**6099**: Garnet-biotite-muscovite-potassium feldspar-quartz unit with local petalite from eastern part of Big Mack pegmatite. Scant oxide grains are present and the largest is circled and platy in outline (ferrocolumbite).

**99FWB-74**: Platy black mainly ferrotantalite grain (some ferrocolumbite), 1 by 10 mm, in a quartz-rich patch situated in the east-central part of the pegmatite. Several polycrystalline aggregates of a white mineral that is likely petalite also occur in the quartz-rich pod. An equant black speck occurs in one of these aggregates.

## ZONE 11 PEGMATITES

**6082**: Garnet-muscovite-petalite pegmatite. Sample from the eastern end of the Zone 11 pegmatites. Garnet and possible cordierite are also present along with several black specks of oxide minerals (ferrocolumbite). Nigerite and gahnite also present.

## PEGMATITE 6059

**6059**: Deformed, vaguely foliated, fine- to coarse-grained, petalite-rich pegmatite. Sparse, fine-grained black specks noted (cassiterite and manganotantalite with rims of manganocolumbite). Spongy, light pink garnets overgrow the recrystallized petalite. Garnet and nigerite also present.

## GLITTER ZONE PEGMATITE

**99-GZ-1**: Garnet-muscovite-plagioclase unit adjacent to amphibolite host rocks at northern contact of pegmatite. Several pin-size, black grains of ferrocolumbite, cassiterite and rare ferrotapiolite are apparent. Nigerite also present.

**99-GZ-2**: Small piece of quartz-plagioclase rock with sparse black ferrocolumbite grains. Loose piece taken from main mass of the pegmatite.

**99-GZ-3**: Biotite-quartz-plagioclase aplite from south part of pegmatite adjacent to amphibolite host rocks. Small black specks of ferrocolumbite present.

**99-GZ-4**: Garnet-quartz-plagioclase unit with local petalite megacrysts from eastern end of pegmatite. Black grains of ferrocolumbite and cassiterite are relatively abundant (lesser amounts of ferrotantalite and ferrotapiolite also found). Sparse, light green beryl is present.

**99-GZ-5**: Material similar to 99GZ-4 and from same area of pegmatite. Ferrocolumbite, cassiterite, ferrowodginite and nigerite are present.

**99-GZ-6**: Garnet aplite near 99GZ-4 and 99GZ-5 that contains the odd speck of black possible oxide minerals (ferrocolumbite, ferrotantalite, cassiterite and ferrowodginite).

**99-GZ-7**: Altered cordierite-bearing unit that dominates in the northeastern part of the pegmatite. Cordierite is pervasively altered to garnet-mica-rich aggregates and variable amount of holmquistite. No oxide minerals readily observed because of fine-grain size, but ferrocolumbite and nigerite found with electron microprobe.

## WOLF ZONE PEGMATITE

**99-WZ-1**: Plagioclase-rich unit with 5 to 10% quartz and relatively abundant black oxide minerals (manganocolumbite and cassiterite).

**99-WZ-2**: Plagioclase-rich unit with a few specks of black oxide grains (manganocolumbite and cassiterite).

**99-WZ-3**: Cleavelandite-rich unit with 10% megacrysts of grey quartz and a small amount of blade to equant black oxide grains (manganocolumbite and cassiterite). One crystal of multi-coloured beryl, 2 cm in diameter, also in specimen.

**99-WZ-4**: Plagioclase-rich unit with 5 to 10% quartz with sparse light green apatite and scattered brown-black oxide grains (manganocolumbite, cassiterite and rare microlite).

# Appendix B

Electron Microprobe Analyses

## Columbite-Tantalite Group

| | **Sep. Rapids pluton** | | | **Separation Rapids pluton** | | | | | **Separation Rapids pluton** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-249A | | | 93-249B | | | | | 93-249C | | | | | | | |
| | UA | UG | UN | ZA | ZC | ZD | ZE | ZI | TD | TF | TG | TP | TQ | TR | TJ | TK |
| FeO | 16.38 | 16.74 | 16.50 | 16.43 | 15.73 | 16.08 | 15.62 | 17.06 | 17.52 | 17.66 | 15.65 | 15.83 | 16.68 | 17.21 | 16.83 | 16.94 |
| MnO | 3.29 | 3.28 | 3.39 | 3.34 | 2.90 | 3.12 | 3.04 | 2.11 | 2.04 | 1.74 | 1.64 | 3.09 | 2.47 | 2.00 | 2.12 | 2.16 |
| TiO2 | 0.47 | 0.57 | 0.52 | 0.45 | 0.96 | 0.71 | 0.75 | 0.71 | 0.64 | 0.60 | 0.57 | 0.53 | 0.56 | 0.55 | 0.58 | 0.55 |
| Nb2O5 | 62.65 | 65.00 | 66.52 | 60.52 | 48.45 | 54.49 | 52.46 | 53.62 | 59.46 | 55.96 | 32.25 | 55.19 | 54.19 | 55.66 | 57.78 | 59.59 |
| Ta2O5 | 15.30 | 12.64 | 13.38 | 18.59 | 30.79 | 24.69 | 27.74 | 26.62 | 18.77 | 22.62 | 50.19 | 24.04 | 26.18 | 24.37 | 21.88 | 20.25 |
| SnO2 | 0.02 | 0.02 | 0.02 | 0.02 | 0.05 | 0.04 | 0.02 | 0.02 | 0.02 | 0.03 | 0.06 | 0.03 | 0.02 | 0.05 | 0.03 | 0.03 |
| WO3 | 0.41 | 0.44 | 0.26 | 0.34 | 0.47 | 0.41 | 0.53 | 0.42 | 0.45 | 0.28 | 0.41 | 0.45 | 0.27 | 0.28 | 0.49 | 0.46 |
| PbO | 0.29 | 0.29 | 0.23 | 0.29 | 0.23 | 0.26 | 0.22 | 0.22 | 0.25 | 0.25 | 0.10 | 0.21 | 0.24 | 0.27 | 0.23 | 0.23 |
| ThO2 | 0.00 | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | | | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | | | |
| Sc2O3 | | | | | | | | | | | | | | | | |
| CaO | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.01 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 |
| Total | 98.84 | 99.02 | 100.87 | 100.03 | 99.63 | 99.83 | 100.41 | 100.80 | 99.18 | 99.18 | 100.91 | 99.40 | 100.65 | 100.42 | 99.95 | 100.25 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.831 | 0.839 | 0.811 | 0.835 | 0.846 | 0.841 | 0.821 | 0.889 | 0.899 | 0.922 | 0.910 | 0.829 | 0.870 | 0.893 | 0.867 | 0.864 |
| Mn | 0.169 | 0.166 | 0.169 | 0.172 | 0.158 | 0.165 | 0.162 | 0.111 | 0.106 | 0.092 | 0.097 | 0.164 | 0.130 | 0.105 | 0.110 | 0.112 |
| Ti | 0.021 | 0.026 | 0.023 | 0.021 | 0.046 | 0.033 | 0.035 | 0.033 | 0.030 | 0.028 | 0.030 | 0.025 | 0.026 | 0.026 | 0.027 | 0.025 |
| Nb | 1.719 | 1.760 | 1.768 | 1.663 | 1.409 | 1.540 | 1.491 | 1.511 | 1.650 | 1.579 | 1.013 | 1.562 | 1.527 | 1.560 | 1.609 | 1.642 |
| Ta | 0.253 | 0.206 | 0.214 | 0.307 | 0.539 | 0.420 | 0.474 | 0.451 | 0.313 | 0.384 | 0.949 | 0.409 | 0.444 | 0.411 | 0.367 | 0.336 |
| Sn | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 |
| W | 0.006 | 0.007 | 0.004 | 0.005 | 0.008 | 0.007 | 0.009 | 0.007 | 0.007 | 0.005 | 0.007 | 0.007 | 0.004 | 0.005 | 0.008 | 0.007 |
| Pb | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.002 | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | | | | | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | | | | | |
| Sc | | | | | | | | | | | | | | | | |
| Ca | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 |
| Total | 3.007 | 3.011 | 2.995 | 3.012 | 3.014 | 3.013 | 2.999 | 3.009 | 3.011 | 3.017 | 3.011 | 3.003 | 3.008 | 3.007 | 2.994 | 2.992 |
| Mn/(Mn+Fe) | 0.169 | 0.166 | 0.172 | 0.171 | 0.157 | 0.164 | 0.165 | 0.111 | 0.105 | 0.091 | 0.096 | 0.165 | 0.130 | 0.105 | 0.113 | 0.114 |
| Ta/(Ta+Nb) | 0.128 | 0.105 | 0.108 | 0.156 | 0.277 | 0.214 | 0.241 | 0.230 | 0.160 | 0.196 | 0.484 | 0.208 | 0.225 | 0.208 | 0.186 | 0.170 |
| Comments: | isolated grains | | | ZA - ZE same grain<br>large tabular grains 0.5 mm in length | | | | | isolated grains associated with dark mica | | | | | | | |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

| | Sep. Rapids pluton | | | | | Separation Rapids pluton | | | | Separation Rapids pluton | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-251 | | | | | 93-260A | | | | 93-260B | | | | | |
| | AB | AC | UE | UF | UG | XA | XB | XC | XD | YA | YB | YC | YD | YE | YF |
| FeO | 16.70 | 16.60 | 16.49 | 16.07 | 16.11 | 0.46 | 0.46 | 0.47 | 0.92 | 1.90 | 1.18 | 1.67 | 2.69 | 2.08 | 1.54 |
| MnO | 3.09 | 3.33 | 3.22 | 2.98 | 3.09 | 14.51 | 14.68 | 14.48 | 14.01 | 14.81 | 15.80 | 15.49 | 14.45 | 15.00 | 15.54 |
| TiO2 | 0.57 | 0.57 | 0.59 | 0.66 | 0.67 | 0.00 | 0.00 | 0.00 | 0.04 | 0.06 | 0.00 | 0.09 | 0.00 | 0.06 | 0.01 |
| Nb2O5 | 63.58 | 62.95 | 60.69 | 52.75 | 50.82 | 15.63 | 17.89 | 16.38 | 17.15 | 37.04 | 38.01 | 40.22 | 39.93 | 39.47 | 39.09 |
| Ta2O5 | 15.99 | 16.77 | 18.85 | 28.00 | 28.51 | 68.39 | 66.22 | 67.57 | 67.30 | 45.88 | 44.94 | 42.32 | 43.31 | 43.45 | 43.64 |
| SnO2 | 0.02 | 0.02 | 0.03 | 0.06 | 0.14 | 0.17 | 0.09 | 0.09 | 0.09 | 0.08 | 0.03 | 0.06 | 0.05 | 0.10 | 0.04 |
| WO3 | 0.37 | 0.31 | 0.48 | 0.28 | 0.53 | 0.27 | 0.17 | 0.24 | 0.18 | 0.59 | 0.42 | 0.45 | 0.15 | 0.38 | 0.52 |
| PbO | 0.30 | 0.27 | 0.26 | 0.27 | 0.21 | 0.00 | 0.06 | 0.05 | 0.00 | 0.17 | 0.18 | 0.15 | 0.13 | 0.19 | 0.20 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | | | | | | 0.02 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 |
| Bi2O3 | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | | | | | | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.05 | 0.01 | 0.04 | 0.04 | 0.00 |
| CaO | 0.01 | 0.03 | 0.04 | 0.04 | 0.03 | | | | | | | | | | |
| Total | 100.63 | 100.85 | 100.65 | 101.11 | 100.11 | 99.46 | 99.57 | 99.41 | 99.71 | 100.52 | 100.64 | 100.48 | 100.75 | 100.76 | 100.59 |
| | Structural formulae based on 6 oxygens | | | | | | | | | | | | | | |
| Fe | 0.833 | 0.829 | 0.833 | 0.840 | 0.855 | 0.030 | 0.030 | 0.030 | 0.059 | 0.108 | 0.067 | 0.094 | 0.151 | 0.117 | 0.087 |
| Mn | 0.156 | 0.168 | 0.165 | 0.158 | 0.166 | 0.955 | 0.953 | 0.949 | 0.912 | 0.857 | 0.909 | 0.881 | 0.823 | 0.855 | 0.889 |
| Ti | 0.026 | 0.026 | 0.027 | 0.031 | 0.032 | 0.000 | 0.000 | 0.000 | 0.002 | 0.003 | 0.000 | 0.005 | 0.000 | 0.003 | 0.001 |
| Nb | 1.715 | 1.700 | 1.657 | 1.491 | 1.458 | 0.549 | 0.620 | 0.573 | 0.596 | 1.144 | 1.167 | 1.221 | 1.213 | 1.201 | 1.194 |
| Ta | 0.259 | 0.272 | 0.310 | 0.476 | 0.492 | 1.446 | 1.380 | 1.422 | 1.407 | 0.852 | 0.830 | 0.773 | 0.791 | 0.795 | 0.802 |
| Sn | 0.000 | 0.000 | 0.001 | 0.001 | 0.004 | 0.005 | 0.003 | 0.003 | 0.003 | 0.002 | 0.001 | 0.002 | 0.001 | 0.003 | 0.001 |
| W | 0.006 | 0.005 | 0.008 | 0.005 | 0.009 | 0.005 | 0.003 | 0.005 | 0.004 | 0.011 | 0.007 | 0.008 | 0.003 | 0.007 | 0.009 |
| Pb | 0.005 | 0.004 | 0.004 | 0.005 | 0.004 | 0.000 | 0.001 | 0.001 | 0.000 | 0.003 | 0.003 | 0.003 | 0.002 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | | | | | | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| Bi | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | | | | | | 0.000 | 0.000 | 0.009 | 0.000 | 0.000 | 0.003 | 0.001 | 0.002 | 0.002 | 0.000 |
| Ca | 0.001 | 0.002 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.001 | 3.006 | 3.007 | 3.009 | 3.021 | 2.992 | 2.990 | 2.992 | 2.983 | 2.980 | 2.987 | 2.987 | 2.986 | 2.986 | 2.987 |
| Mn/(Mn+Fe) | 0.158 | 0.169 | 0.165 | 0.158 | 0.163 | 0.969 | 0.970 | 0.969 | 0.939 | 0.888 | 0.931 | 0.904 | 0.845 | 0.880 | 0.911 |
| Ta/(Ta+Nb) | 0.131 | 0.138 | 0.157 | 0.242 | 0.252 | 0.725 | 0.690 | 0.713 | 0.702 | 0.427 | 0.416 | 0.388 | 0.395 | 0.398 | 0.402 |
| Comments: | | isolated grains | | UF & UG<br>same grain | | | | | | YA & YB<br>same grain | | YC - YF<br>same grain | | | |

## Columbite-Tantalite Group

**Separation Rapids pluton**

93-260C

| | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK | AL | AM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.86 | 4.26 | 4.45 | 6.26 | 8.36 | 4.14 | 10.48 | 6.37 | 3.40 | 4.27 | 3.76 | 9.94 | 6.89 |
| MnO | 11.59 | 11.26 | 11.00 | 9.57 | 7.77 | 11.31 | 5.80 | 9.41 | 11.90 | 11.06 | 12.29 | 6.28 | 9.28 |
| TiO2 | 0.01 | 0.07 | 0.08 | 0.13 | 0.10 | 0.10 | 0.12 | 0.15 | 0.18 | 0.20 | 0.09 | 0.14 | 0.13 |
| Nb2O5 | 13.91 | 18.83 | 20.27 | 23.03 | 24.48 | 17.24 | 25.52 | 22.44 | 17.59 | 16.89 | 26.52 | 24.70 | 23.23 |
| Ta2O5 | 70.21 | 64.94 | 63.89 | 60.74 | 58.84 | 66.45 | 57.36 | 60.54 | 65.96 | 66.15 | 57.62 | 58.75 | 59.52 |
| SnO2 | 0.07 | 0.04 | 0.06 | 0.22 | 0.06 | 0.08 | 0.19 | 0.34 | 0.11 | 0.56 | 0.08 | 0.11 | 0.11 |
| WO3 | 0.19 | 0.28 | 0.26 | 0.16 | 0.07 | 0.24 | 0.11 | 0.38 | 0.24 | 0.29 | 0.33 | 0.07 | 0.13 |
| PbO | 0.00 | 0.00 | 0.02 | 0.06 | 0.12 | 0.07 | 0.15 | 0.03 | 0.06 | 0.04 | 0.09 | 0.10 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 | 0.06 |
| CaO | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 |
| Total | 98.85 | 99.71 | 100.02 | 100.16 | 99.80 | 99.68 | 99.72 | 99.70 | 99.46 | 99.44 | 100.82 | 100.11 | 99.37 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.189 | 0.271 | 0.280 | 0.387 | 0.514 | 0.266 | 0.642 | 0.396 | 0.218 | 0.275 | 0.227 | 0.609 | 0.428 |
| Mn | 0.776 | 0.725 | 0.701 | 0.599 | 0.484 | 0.735 | 0.359 | 0.592 | 0.773 | 0.721 | 0.750 | 0.390 | 0.583 |
| Ti | 0.001 | 0.004 | 0.004 | 0.007 | 0.006 | 0.006 | 0.006 | 0.009 | 0.010 | 0.012 | 0.005 | 0.008 | 0.007 |
| Nb | 0.497 | 0.647 | 0.689 | 0.769 | 0.814 | 0.598 | 0.845 | 0.754 | 0.610 | 0.588 | 0.864 | 0.818 | 0.780 |
| Ta | 1.509 | 1.343 | 1.307 | 1.221 | 1.178 | 1.387 | 1.142 | 1.224 | 1.376 | 1.384 | 1.130 | 1.171 | 1.202 |
| Sn | 0.002 | 0.001 | 0.002 | 0.006 | 0.002 | 0.003 | 0.006 | 0.010 | 0.003 | 0.017 | 0.002 | 0.003 | 0.003 |
| W | 0.004 | 0.005 | 0.005 | 0.003 | 0.001 | 0.005 | 0.002 | 0.007 | 0.005 | 0.006 | 0.006 | 0.001 | 0.003 |
| Pb | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 | 0.004 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 |
| Total | 2.979 | 2.998 | 2.989 | 2.995 | 3.002 | 3.004 | 3.004 | 2.997 | 2.998 | 3.002 | 2.989 | 3.003 | 3.010 |
| Mn/(Mn+Fe) | 0.804 | 0.728 | 0.715 | 0.608 | 0.485 | 0.735 | 0.359 | 0.599 | 0.780 | 0.724 | 0.768 | 0.390 | 0.577 |
| Ta/(Ta+Nb) | 0.752 | 0.675 | 0.655 | 0.613 | 0.591 | 0.699 | 0.575 | 0.619 | 0.693 | 0.702 | 0.567 | 0.589 | 0.607 |

Comments: all analyses from inclusions in cassiterite (7 grains)
AA - AC same inclusion

| | Separation Rapids pluton | | | | | | | | | | East Beryl pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-260C | | | | | | | | | | 93-262A | | |
| | AP | AQ | AR | AS | AT | AU | AV | AW | AX | AZ | BB | BJ | BK |
| FeO | 6.35 | 4.24 | 10.16 | 4.65 | 4.79 | 4.16 | 3.80 | 3.71 | 3.79 | 3.94 | 16.17 | 15.40 | 16.67 |
| MnO | 9.15 | 11.57 | 6.13 | 10.99 | 10.56 | 12.04 | 12.30 | 12.13 | 12.14 | 12.81 | 4.77 | 4.53 | 4.19 |
| TiO2 | 0.07 | 0.03 | 0.09 | 0.03 | 0.09 | 0.07 | 0.02 | 0.13 | 0.10 | 0.18 | 0.63 | 0.57 | 0.67 |
| Nb2O5 | 18.37 | 20.71 | 23.77 | 19.41 | 18.34 | 24.45 | 24.28 | 22.20 | 21.88 | 30.96 | 64.41 | 65.47 | 64.20 |
| Ta2O5 | 64.14 | 62.67 | 59.44 | 64.86 | 65.60 | 58.47 | 58.50 | 61.29 | 61.25 | 51.88 | 13.30 | 13.13 | 13.63 |
| SnO2 | 0.44 | 0.08 | 0.07 | 0.03 | 0.13 | 0.10 | 0.01 | 0.12 | 0.12 | 0.06 | 0.02 | 0.02 | 0.03 |
| WO3 | 0.24 | 0.22 | 0.14 | 0.29 | 0.19 | 0.35 | 0.42 | 0.18 | 0.24 | 0.51 | 0.77 | 0.53 | 0.69 |
| PbO | 0.04 | 0.04 | 0.11 | 0.02 | 0.06 | 0.06 | 0.11 | 0.09 | 0.12 | 0.04 | 0.28 | 0.30 | 0.28 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | |
| Sc2O3 | 0.06 | 0.01 | 0.00 | 0.00 | 0.03 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | | | |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.03 | 0.04 | 0.03 |
| Total | 98.85 | 99.57 | 99.90 | 100.27 | 99.80 | 99.69 | 99.54 | 99.86 | 99.64 | 100.37 | 100.43 | 99.99 | 100.39 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.408 | 0.267 | 0.627 | 0.293 | 0.305 | 0.256 | 0.235 | 0.231 | 0.237 | 0.232 | 0.803 | 0.765 | 0.828 |
| Mn | 0.595 | 0.738 | 0.383 | 0.702 | 0.682 | 0.750 | 0.768 | 0.765 | 0.768 | 0.764 | 0.240 | 0.228 | 0.211 |
| Ti | 0.004 | 0.001 | 0.005 | 0.001 | 0.005 | 0.004 | 0.001 | 0.007 | 0.006 | 0.010 | 0.028 | 0.025 | 0.030 |
| Nb | 0.638 | 0.705 | 0.793 | 0.662 | 0.632 | 0.813 | 0.810 | 0.747 | 0.739 | 0.986 | 1.728 | 1.757 | 1.724 |
| Ta | 1.339 | 1.284 | 1.193 | 1.331 | 1.360 | 1.170 | 1.174 | 1.241 | 1.245 | 0.994 | 0.215 | 0.212 | 0.220 |
| Sn | 0.013 | 0.002 | 0.002 | 0.001 | 0.004 | 0.003 | 0.000 | 0.003 | 0.004 | 0.002 | 0.000 | 0.000 | 0.001 |
| W | 0.005 | 0.004 | 0.003 | 0.006 | 0.004 | 0.007 | 0.008 | 0.003 | 0.005 | 0.009 | 0.012 | 0.008 | 0.011 |
| Pb | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.004 | 0.005 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | |
| Sc | 0.004 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | | | |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.003 | 0.002 |
| Total | 3.006 | 3.004 | 3.008 | 2.997 | 2.995 | 3.005 | 3.005 | 3.001 | 3.006 | 2.999 | 3.033 | 3.003 | 3.031 |
| Mn/(Mn+Fe) | 0.593 | 0.734 | 0.379 | 0.705 | 0.691 | 0.746 | 0.766 | 0.768 | 0.764 | 0.767 | 0.230 | 0.230 | 0.203 |
| Ta/(Ta+Nb) | 0.677 | 0.645 | 0.601 | 0.668 | 0.683 | 0.590 | 0.592 | 0.624 | 0.627 | 0.502 | 0.111 | 0.108 | 0.113 |
| Comments: | all analyses from inclusions in cassiterite (7 grains) | | | | | | | | | | BB - BK<br>same grain<br>isolated grains | | |

## Columbite-Tantalite Group

**East Beryl pegmatite**
**93-262B**

| | LF | LG | LH | LI | LK | KA1 | KA2 | KA3 | KA4 | KA5 | KA6 | KA7 | KA8 | KB | KC | KD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.19 | 12.18 | 11.00 | 10.26 | 12.95 | 8.38 | 8.94 | 9.60 | 10.10 | 11.07 | 11.34 | 12.34 | 13.50 | 12.53 | 14.33 | 13.57 |
| MnO | 5.26 | 5.17 | 5.55 | 6.73 | 5.43 | 7.09 | 6.51 | 5.56 | 5.63 | 4.67 | 4.84 | 4.93 | 5.30 | 5.04 | 5.26 | 5.15 |
| TiO2 | 0.54 | 0.57 | 0.84 | 1.03 | 0.64 | 0.80 | 0.86 | 0.91 | 0.86 | 0.74 | 0.48 | 0.65 | 0.46 | 0.44 | 0.58 | 0.72 |
| Nb2O5 | 45.17 | 30.00 | 24.61 | 26.76 | 41.40 | 16.91 | 16.71 | 14.97 | 19.12 | 18.85 | 20.30 | 31.40 | 45.69 | 35.08 | 55.04 | 46.08 |
| Ta2O5 | 35.77 | 51.35 | 57.32 | 54.11 | 38.45 | 65.23 | 65.29 | 66.41 | 61.77 | 62.29 | 61.86 | 48.66 | 32.73 | 45.19 | 22.52 | 32.43 |
| SnO2 | 0.03 | 0.06 | 0.37 | 0.15 | 0.02 | 0.07 | 0.16 | 0.35 | 0.55 | 0.40 | 0.15 | 0.07 | 0.04 | 0.08 | 0.05 | 0.11 |
| WO3 | 0.27 | 0.10 | 0.27 | 0.18 | 0.30 | 0.61 | 0.51 | 0.57 | 0.67 | 0.58 | 0.37 | 0.51 | 0.54 | 0.46 | 0.59 | 0.27 |
| PbO | 0.14 | 0.06 | 0.11 | 0.16 | 0.25 | 0.09 | 0.10 | 0.09 | 0.13 | 0.12 | 0.10 | 0.21 | 0.21 | 0.12 | 0.27 | 0.26 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.02 | 0.02 | 0.16 | 0.05 | 0.00 | 0.02 | 0.11 | 0.06 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | | | | | | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | | | | | | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.00 | 0.04 | 0.00 | 0.03 | 0.00 | 0.00 |
| Sc2O3 | | | | | | 0.14 | 0.00 | 0.25 | 0.10 | 0.17 | 0.00 | 0.00 | 0.00 | 0.05 | 0.03 | 0.12 |
| CaO | 0.04 | 0.04 | 0.05 | 0.08 | 0.05 | 0.02 | 0.01 | 0.05 | 0.01 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 100.42 | 99.55 | 100.14 | 99.63 | 99.56 | 99.36 | 99.12 | 98.86 | 99.00 | 98.96 | 99.47 | 98.81 | 98.50 | 99.02 | 98.69 | 98.71 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.719 | 0.724 | 0.669 | 0.618 | 0.724 | 0.536 | 0.574 | 0.623 | 0.639 | 0.703 | 0.714 | 0.732 | 0.745 | 0.729 | 0.753 | 0.745 |
| Mn | 0.291 | 0.311 | 0.342 | 0.410 | 0.308 | 0.460 | 0.423 | 0.365 | 0.361 | 0.300 | 0.308 | 0.296 | 0.296 | 0.297 | 0.280 | 0.286 |
| Ti | 0.026 | 0.030 | 0.046 | 0.056 | 0.032 | 0.046 | 0.050 | 0.053 | 0.049 | 0.042 | 0.027 | 0.035 | 0.023 | 0.023 | 0.027 | 0.035 |
| Nb | 1.332 | 0.964 | [illegible] | 0.871 | 1.252 | 0.585 | 0.580 | 0.525 | 0.654 | 0.647 | 0.690 | 1.007 | 1.364 | 1.102 | 1.564 | 1.367 |
| Ta | 0.634 | 0.992 | 1.133 | 1.060 | 0.699 | 1.357 | 1.363 | 1.401 | 1.271 | 1.286 | 1.265 | 0.939 | 0.588 | 0.854 | 0.385 | 0.579 |
| Sn | 0.001 | 0.002 | 0.011 | 0.004 | 0.001 | 0.002 | 0.005 | 0.011 | 0.017 | 0.012 | 0.005 | 0.002 | 0.001 | 0.002 | 0.001 | 0.003 |
| W | 0.005 | 0.002 | 0.005 | 0.003 | 0.005 | 0.012 | 0.010 | 0.011 | 0.013 | 0.011 | 0.007 | 0.009 | 0.009 | 0.008 | 0.010 | 0.005 |
| Pb | 0.002 | 0.001 | 0.002 | 0.003 | 0.005 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.004 | 0.004 | 0.002 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | | | | | | 0.009 | 0.000 | 0.017 | 0.007 | 0.011 | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.007 |
| Ca | 0.003 | 0.003 | 0.004 | 0.006 | 0.004 | 0.002 | 0.001 | 0.004 | 0.000 | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.014 | 3.030 | 3.020 | 3.034 | 3.030 | 3.011 | 3.009 | 3.014 | 3.015 | 3.018 | 3.020 | 3.025 | 3.030 | 3.021 | 3.027 | 3.031 |
| Mn/(Mn+Fe) | 0.288 | 0.301 | 0.338 | 0.399 | 0.298 | 0.462 | 0.424 | 0.370 | 0.361 | 0.299 | 0.302 | 0.288 | 0.284 | 0.289 | 0.271 | 0.278 |
| Ta/(Ta+Nb) | 0.323 | 0.507 | 0.584 | 0.549 | 0.358 | 0.699 | 0.702 | 0.727 | 0.660 | 0.665 | 0.647 | 0.482 | 0.301 | 0.437 | 0.198 | 0.297 |
| Comments: | all data from single grain | | | | | traverse from KA core to KB rim | | | | | | | | rim | overgrowth | |
| | | | | | | | | | | | | | | | early | late |

**East Beryl pegmatite**

93-262C

|  | YG | YH | YJ | YK1 | YK2 | YK3 | YK4 | YK5 | YK6 | YK7 | YK8 | YK9 | YK10 | YK11 | YK12 | YK13 | YK14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 15.27 | 12.57 | 14.86 | 15.57 | 13.86 | 16.47 | 17.00 | 15.11 | 14.21 | 15.06 | 15.37 | 15.11 | 15.59 | 15.44 | 14.13 | 14.95 | 15.05 |
| MnO | 4.79 | 7.29 | 5.19 | 4.40 | 6.00 | 3.91 | 3.27 | 4.97 | 5.30 | 5.00 | 4.61 | 5.06 | 4.58 | 4.73 | 5.52 | 5.15 | 5.20 |
| TiO2 | 0.77 | 1.64 | 0.76 | 0.55 | 0.59 | 0.43 | 0.64 | 0.69 | 0.65 | 0.57 | 0.54 | 0.68 | 0.67 | 0.64 | 0.66 | 0.60 | 0.64 |
| Nb2O5 | 62.78 | 64.12 | 61.56 | 60.90 | 61.83 | 63.34 | 62.13 | 62.08 | 57.21 | 60.99 | 63.37 | 62.55 | 62.29 | 63.73 | 58.79 | 62.85 | 62.37 |
| Ta2O5 | 13.38 | 11.07 | 14.03 | 17.14 | 15.33 | 14.16 | 14.29 | 14.55 | 20.60 | 15.77 | 13.87 | 14.99 | 14.12 | 14.04 | 20.06 | 14.23 | 14.72 |
| SnO2 | 0.06 | 0.03 | 0.03 | 0.02 | 0.07 | 0.02 | 0.00 | 0.08 | 0.09 | 0.04 | 0.01 | 0.08 | 0.07 | 0.12 | 0.09 | 0.08 | 0.05 |
| WO3 | 0.70 | 0.77 | 0.60 | 1.07 | 0.82 | 0.67 | 1.42 | 1.40 | 0.63 | 0.94 | 1.20 | 1.06 | 1.44 | 0.91 | 0.71 | 0.86 | 1.09 |
| PbO | 0.32 | 0.37 | 0.24 | 0.32 | 0.29 | 0.36 | 0.21 | 0.33 | 0.33 | 0.31 | 0.13 | 0.11 | 0.35 | 0.23 | 0.00 | 0.24 | 0.34 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 |  |  |  | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 |  |  |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 |  |  |  | 0.00 | 0.04 | 0.12 | 0.19 | 0.11 | 0.00 | 0.01 | 0.09 | 0.07 | 0.00 | 0.02 | 0.00 | 0.00 | 0.07 |
| CaO | 0.03 | 0.03 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Total | 100.76 | 100.68 | 99.90 | 100.00 | 98.85 | 99.48 | 99.16 | 99.34 | 99.02 | 98.70 | 99.19 | 99.69 | 99.11 | 99.87 | 99.97 | 98.96 | 99.53 |
| **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.754 | 0.613 | 0.742 | 0.789 | 0.705 | 0.829 | 0.859 | 0.763 | 0.737 | 0.770 | 0.774 | 0.759 | 0.789 | 0.772 | 0.722 | 0.756 | 0.759 |
| Mn | 0.239 | 0.360 | 0.262 | 0.226 | 0.309 | 0.199 | 0.167 | 0.254 | 0.279 | 0.259 | 0.235 | 0.257 | 0.234 | 0.239 | 0.285 | 0.264 | 0.266 |
| Ti | 0.034 | 0.072 | 0.034 | 0.025 | 0.027 | 0.019 | 0.029 | 0.031 | 0.031 | 0.026 | 0.024 | 0.031 | 0.030 | 0.029 | 0.031 | 0.027 | 0.029 |
| Nb | 1.742 | 1.757 | 1.727 | 1.668 | 1.699 | 1.723 | 1.697 | 1.695 | 1.605 | 1.685 | 1.724 | 1.700 | 1.703 | 1.723 | 1.624 | 1.717 | 1.700 |
| Ta | 0.217 | 0.177 | 0.230 | 0.282 | 0.253 | 0.232 | 0.235 | 0.239 | 0.348 | 0.262 | 0.227 | 0.245 | 0.232 | 0.228 | 0.333 | 0.234 | 0.241 |
| Sn | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.000 | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 |
| W | 0.011 | 0.012 | 0.009 | 0.017 | 0.013 | 0.011 | 0.022 | 0.022 | 0.010 | 0.015 | 0.019 | 0.016 | 0.023 | 0.014 | 0.011 | 0.013 | 0.017 |
| Pb | 0.005 | 0.006 | 0.004 | 0.005 | 0.005 | 0.006 | 0.003 | 0.005 | 0.005 | 0.005 | 0.002 | 0.002 | 0.006 | 0.004 | 0.000 | 0.004 | 0.006 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb |  |  |  | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi |  |  |  | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc |  |  |  | 0.000 | 0.002 | 0.006 | 0.010 | 0.006 | 0.000 | 0.000 | 0.005 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.004 |
| Ca | 0.002 | 0.002 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Total | 3.005 | 3.001 | 3.011 | 3.014 | 3.015 | 3.025 | 3.023 | 3.019 | 3.018 | 3.023 | 3.009 | 3.016 | 3.019 | 3.013 | 3.009 | 3.017 | 3.022 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mn/(Mn+Fe) | 0.241 | 0.370 | 0.261 | 0.222 | 0.305 | 0.194 | 0.163 | 0.250 | 0.274 | 0.251 | 0.233 | 0.253 | 0.229 | 0.237 | 0.283 | 0.259 | 0.259 |
| Ta/(Ta+Nb) | 0.111 | 0.092 | 0.117 | 0.145 | 0.130 | 0.119 | 0.122 | 0.124 | 0.178 | 0.135 | 0.116 | 0.126 | 0.120 | 0.117 | 0.170 | 0.120 | 0.124 |

**Comments:** YK traverse across 3400 µm grain
minor oscillatory and patchy zonation

**East Beryl pegmatite**

93-262C

| | YK15 | YK16 | YK17 | YK18 | YK19 | YK20 | YK21 | YK22 | YK23 | YK24 | YK25 | YK26 | YK27 | YK28 | YK29 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 15.26 | 15.40 | 16.68 | 17.02 | 16.92 | 16.89 | 15.50 | 16.62 | 16.99 | 16.89 | 14.70 | 14.30 | 16.37 | 16.47 | 16.72 |
| MnO | 4.89 | 4.79 | 3.63 | 3.30 | 3.29 | 3.25 | 4.63 | 3.56 | 3.20 | 3.35 | 5.53 | 5.61 | 3.55 | 3.48 | 3.48 |
| TiO2 | 0.70 | 0.68 | 0.57 | 0.50 | 0.62 | 0.60 | 0.68 | 0.61 | 0.67 | 0.63 | 0.47 | 0.55 | 0.55 | 0.52 | 0.59 |
| Nb2O5 | 63.11 | 63.00 | 63.21 | 63.11 | 62.81 | 62.86 | 62.95 | 62.48 | 62.74 | 62.56 | 64.44 | 62.80 | 60.62 | 61.09 | 63.06 |
| Ta2O5 | 14.52 | 14.02 | 14.13 | 13.99 | 13.94 | 14.14 | 14.34 | 13.57 | 13.80 | 13.66 | 12.98 | 14.88 | 16.60 | 16.33 | 14.86 |
| SnO2 | 0.09 | 0.06 | 0.00 | 0.03 | 0.07 | 0.00 | 0.07 | 0.07 | 0.02 | 0.01 | 0.00 | 0.06 | 0.05 | 0.05 | 0.07 |
| WO3 | 0.79 | 1.19 | 1.18 | 1.15 | 1.43 | 1.43 | 1.28 | 1.45 | 1.40 | 1.43 | 0.69 | 0.96 | 1.14 | 1.06 | 1.10 |
| PbO | 0.26 | 0.30 | 0.32 | 0.32 | 0.34 | 0.27 | 0.34 | 0.34 | 0.28 | 0.29 | 0.26 | 0.24 | 0.24 | 0.32 | 0.35 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.04 | 0.15 | 0.10 | 0.02 | 0.00 | 0.16 | 0.10 | 0.01 | 0.03 | 0.04 | 0.04 | 0.03 | 0.05 | 0.00 | 0.09 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.67 | 99.57 | 99.84 | 99.44 | 99.46 | 99.63 | 99.90 | 98.77 | 99.15 | 98.87 | 99.10 | 99.43 | 99.18 | 99.35 | 100.33 |
| | | | | | | | | | | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.766 | 0.773 | 0.836 | 0.857 | 0.852 | 0.849 | 0.777 | 0.842 | 0.857 | 0.855 | 0.738 | 0.721 | 0.835 | 0.838 | 0.836 |
| Mn | 0.249 | 0.244 | 0.184 | 0.168 | 0.168 | 0.165 | 0.235 | 0.183 | 0.164 | 0.172 | 0.281 | 0.286 | 0.184 | 0.179 | 0.176 |
| Ti | 0.032 | 0.031 | 0.026 | 0.023 | 0.028 | 0.027 | 0.031 | 0.028 | 0.030 | 0.029 | 0.021 | 0.025 | 0.025 | 0.024 | 0.027 |
| Nb | 1.712 | 1.710 | 1.713 | 1.718 | 1.710 | 1.708 | 1.706 | 1.712 | 1.711 | 1.711 | 1.748 | 1.711 | 1.671 | 1.680 | 1.705 |
| Ta | 0.237 | 0.229 | 0.230 | 0.229 | 0.228 | 0.231 | 0.234 | 0.224 | 0.226 | 0.225 | 0.212 | 0.244 | 0.275 | 0.270 | 0.242 |
| Sn | 0.002 | 0.001 | 0.000 | 0.001 | 0.002 | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 |
| W | 0.012 | 0.018 | 0.018 | 0.018 | 0.022 | 0.022 | 0.020 | 0.023 | 0.022 | 0.022 | 0.011 | 0.015 | 0.018 | 0.017 | 0.017 |
| Pb | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.006 | 0.005 | 0.005 | 0.004 | 0.004 | 0.004 | 0.005 | 0.006 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.008 | 0.005 | 0.001 | 0.000 | 0.008 | 0.005 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.000 | 0.005 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.017 | 3.019 | 3.019 | 3.020 | 3.017 | 3.016 | 3.015 | 3.021 | 3.018 | 3.021 | 3.017 | 3.010 | 3.016 | 3.015 | 3.015 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.245 | 0.240 | 0.181 | 0.164 | 0.165 | 0.163 | 0.232 | 0.178 | 0.160 | 0.167 | 0.276 | 0.284 | 0.180 | 0.176 | 0.174 |
| Ta/(Ta+Nb) | 0.122 | 0.118 | 0.119 | 0.118 | 0.118 | 0.119 | 0.120 | 0.116 | 0.117 | 0.116 | 0.108 | 0.125 | 0.141 | 0.139 | 0.124 |

Comments: YK traverse across grain

| | East Beryl pegmatite | | | | | | East Beryl pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-263 | | | | | | 93-265A | | | | | |
| | VA | VD | VF | VH | VJ | VL | ZB | ZC | ZJ | ZD | LC | LD |
| FeO | 2.66 | 2.51 | 1.34 | 2.30 | 1.86 | 1.65 | 0.31 | 0.33 | 0.36 | 0.29 | 0.60 | 0.53 |
| MnO | 15.18 | 14.20 | 14.57 | 13.74 | 13.77 | 13.66 | 13.69 | 13.76 | 13.91 | 14.08 | 15.50 | 15.09 |
| TiO2 | 0.23 | 0.29 | 0.48 | 0.49 | 0.54 | 0.41 | 0.06 | 0.09 | 0.08 | 0.11 | 0.11 | 0.13 |
| Nb2O5 | 41.22 | 30.02 | 22.85 | 21.75 | 22.12 | 18.89 | 1.87 | 2.01 | 1.55 | 1.68 | 18.65 | 17.43 |
| Ta2O5 | 40.54 | 52.10 | 59.52 | 61.69 | 61.14 | 64.82 | 83.45 | 82.78 | 83.06 | 84.06 | 65.46 | 66.48 |
| SnO2 | 0.02 | 0.36 | 0.15 | 0.20 | 0.27 | 0.70 | 0.31 | 0.80 | 0.51 | 0.06 | 0.08 | 0.09 |
| WO3 | 0.03 | 0.00 | 0.21 | 0.18 | 0.15 | 0.00 | 0.39 | 0.53 | 0.47 | 0.04 | 0.30 | 0.16 |
| PbO | 0.23 | 0.11 | 0.13 | 0.18 | 0.13 | 0.15 | 0.00 | 0.02 | 0.00 | 0.00 | 0.07 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | |
| Sc2O3 | | | | | | | | | | | 0.05 | 0.05 |
| CaO | 0.04 | 0.08 | 0.08 | 0.12 | 0.07 | 0.05 | 0.10 | 0.07 | 0.13 | 0.04 | 0.05 | 0.04 |
| Total | 100.15 | 99.67 | 99.34 | 100.68 | 100.06 | 100.38 | 100.18 | 100.39 | 100.07 | 100.36 | 100.90 | 100.04 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.149 | 0.149 | 0.083 | 0.142 | 0.115 | 0.104 | 0.022 | 0.023 | 0.025 | 0.020 | 0.038 | 0.034 |
| Mn | 0.860 | 0.856 | 0.915 | 0.859 | 0.863 | 0.871 | 0.974 | 0.975 | 0.991 | 1.001 | 0.987 | 0.975 |
| Ti | 0.012 | 0.016 | 0.027 | 0.027 | 0.030 | 0.023 | 0.004 | 0.006 | 0.005 | 0.007 | 0.006 | 0.007 |
| Nb | 1.246 | 0.966 | 0.766 | 0.726 | 0.740 | 0.643 | 0.071 | 0.076 | 0.059 | 0.064 | 0.634 | 0.601 |
| Ta | 0.737 | 1.008 | 1.201 | 1.238 | 1.231 | 1.328 | 1.906 | 1.883 | 1.900 | 1.918 | 1.338 | 1.379 |
| Sn | 0.001 | 0.010 | 0.004 | 0.006 | 0.008 | 0.021 | 0.010 | 0.027 | 0.017 | 0.002 | 0.002 | 0.003 |
| W | 0.001 | 0.000 | 0.004 | 0.003 | 0.003 | 0.000 | 0.008 | 0.011 | 0.010 | 0.001 | 0.006 | 0.003 |
| Pb | 0.004 | 0.002 | 0.003 | 0.004 | 0.003 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | |
| Sc | | | | | | | | | | | 0.003 | 0.003 |
| Ca | 0.003 | 0.006 | 0.006 | 0.009 | 0.006 | 0.004 | 0.009 | 0.006 | 0.012 | 0.004 | 0.004 | 0.003 |
| Total | 3.012 | 3.013 | 3.010 | 3.014 | 2.999 | 2.999 | 3.004 | 3.007 | 3.019 | 3.016 | 3.020 | 3.011 |
| Mn/(Mn+Fe) | 0.853 | 0.851 | 0.917 | 0.858 | 0.882 | 0.893 | 0.978 | 0.977 | 0.975 | 0.980 | 0.963 | 0.966 |
| Ta/(Ta+Nb) | 0.372 | 0.511 | 0.610 | 0.630 | 0.624 | 0.674 | 0.964 | 0.961 | 0.970 | 0.968 | 0.679 | 0.696 |
| Comments: | | | | | | | ZB , ZC & ZJ<br>same grain<br>most evolved sample from Separation area | | | | | |

| | East Beryl pegmatite | | | | | | | East Be peg. | East Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-265A | | | | | | | 93-265AM | 93-265J | | | | |
| | JA | JB | JC | JD | JE | JF | JG | KJ | PC | PE | PF | PG | PH |
| FeO | 0.70 | 0.50 | 0.48 | 0.48 | 0.51 | 0.48 | 0.48 | 0.49 | 2.62 | 2.20 | 2.03 | 2.27 | 3.08 |
| MnO | 15.25 | 15.84 | 14.35 | 14.42 | 14.81 | 14.46 | 14.48 | 13.12 | 15.70 | 15.83 | 15.75 | 16.17 | 15.12 |
| TiO2 | 0.09 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.31 | 0.29 | 0.18 | 0.44 | 0.36 |
| Nb2O5 | 20.88 | 20.31 | 13.66 | 14.01 | 17.34 | 14.35 | 14.16 | 2.47 | 45.51 | 45.49 | 39.97 | 45.96 | 40.47 |
| Ta2O5 | 57.06 | 54.48 | 70.88 | 70.68 | 66.15 | 70.57 | 70.21 | 82.99 | 35.82 | 36.47 | 42.67 | 35.00 | 40.53 |
| SnO2 | 0.88 | 0.77 | 0.00 | 0.00 | 0.11 | 0.00 | 0.04 | 0.77 | 0.02 | 0.08 | 0.02 | 0.08 | 0.03 |
| WO3 | 4.53 | 8.09 | 0.42 | 0.33 | 0.76 | 0.37 | 0.45 | 0.13 | 0.41 | 0.34 | 0.14 | 0.54 | 0.39 |
| PbO | 0.10 | 0.01 | 0.02 | 0.00 | 0.01 | 0.12 | 0.06 | 0.12 | 0.14 | 0.15 | 0.11 | 0.17 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.04 | 0.18 | | | | | |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | | | | | |
| Sc2O3 | 0.00 | 0.01 | 0.10 | 0.02 | 0.00 | 0.00 | 0.00 | 0.11 | | | | | |
| CaO | 0.02 | 0.01 | 0.00 | 0.01 | 0.03 | 0.00 | 0.02 | 0.00 | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 |
| Total | 99.50 | 100.06 | 99.90 | 99.94 | 99.77 | 100.35 | 99.93 | 100.22 | 100.57 | 100.89 | 100.91 | 100.67 | 100.15 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.044 | 0.031 | 0.031 | 0.031 | 0.033 | 0.031 | 0.031 | 0.034 | 0.143 | 0.120 | 0.114 | 0.123 | 0.172 |
| Mn | 0.965 | 0.996 | 0.952 | 0.954 | 0.962 | 0.953 | 0.958 | 0.927 | 0.866 | 0.872 | 0.892 | 0.888 | 0.857 |
| Ti | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.015 | 0.014 | 0.009 | 0.021 | 0.018 |
| Nb | 0.705 | 0.682 | 0.483 | 0.495 | 0.601 | 0.504 | 0.500 | 0.093 | 1.339 | 1.337 | 1.209 | 1.347 | 1.225 |
| Ta | 1.159 | 1.100 | 1.509 | 1.502 | 1.379 | 1.492 | 1.491 | 1.883 | 0.634 | 0.645 | 0.776 | 0.617 | 0.738 |
| Sn | 0.026 | 0.023 | 0.000 | 0.000 | 0.003 | 0.000 | 0.001 | 0.026 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 |
| W | 0.088 | 0.156 | 0.008 | 0.007 | 0.015 | 0.007 | 0.009 | 0.003 | 0.007 | 0.006 | 0.002 | 0.009 | 0.007 |
| Pb | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.006 | | | | | |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | | | | | |
| Sc | 0.000 | 0.001 | 0.006 | 0.001 | 0.000 | 0.000 | 0.000 | 0.008 | | | | | |
| Ca | 0.001 | 0.001 | 0.000 | 0.001 | 0.002 | 0.000 | 0.002 | 0.000 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 |
| Total | 2.996 | 2.991 | 2.991 | 2.991 | 2.996 | 2.990 | 2.994 | 2.990 | 3.010 | 3.000 | 3.008 | 3.013 | 3.023 |
| Mn/(Mn+Fe) | 0.956 | 0.970 | 0.968 | 0.968 | 0.967 | 0.968 | 0.968 | 0.964 | 0.859 | 0.879 | 0.887 | 0.878 | 0.833 |
| Ta/(Ta+Nb) | 0.622 | 0.617 | 0.757 | 0.752 | 0.696 | 0.747 | 0.749 | 0.953 | 0.321 | 0.325 | 0.391 | 0.314 | 0.376 |
| Comments: | JA & JB ragged but homogeneous | | JC - JG same grain | | | | | inclusion in mica | patchy zoned early crystallized part of grain | | | | |

**East Beryl pegmatite**

93-265J

| | HA1 | HA2 | HA3 | HA4 | HA5 | HA6 | HA7 | HA8 | HA9 | HA10 | HA11 | HA12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.08 | 1.99 | 2.01 | 2.20 | 2.30 | 2.19 | 2.05 | 2.08 | 2.11 | 2.07 | 2.05 | 2.02 |
| MnO | 14.03 | 14.03 | 14.33 | 14.48 | 15.20 | 15.22 | 14.83 | 15.21 | 15.16 | 15.15 | 15.58 | 15.14 |
| TiO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.06 | 0.04 | 0.02 | 0.03 | 0.04 | 0.02 | 0.01 |
| Nb2O5 | 26.64 | 25.07 | 29.61 | 34.20 | 41.48 | 41.13 | 35.88 | 39.22 | 39.12 | 38.45 | 41.79 | 36.78 |
| Ta2O5 | 57.01 | 58.26 | 53.97 | 47.32 | 40.37 | 40.38 | 46.29 | 42.05 | 42.01 | 42.82 | 39.46 | 44.58 |
| SnO2 | 0.03 | 0.07 | 0.06 | 0.02 | 0.00 | 0.03 | 0.04 | 0.07 | 0.01 | 0.05 | 0.02 | 0.02 |
| WO3 | 0.27 | 0.34 | 0.27 | 0.32 | 0.37 | 0.37 | 0.38 | 0.44 | 0.38 | 0.34 | 0.38 | 0.43 |
| PbO | 0.10 | 0.06 | 0.17 | 0.17 | 0.24 | 0.19 | 0.15 | 0.22 | 0.21 | 0.22 | 0.21 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 |
| CaO | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 |
| Total | 100.28 | 99.85 | 100.43 | 98.73 | 99.98 | 99.60 | 99.73 | 99.33 | 99.03 | 99.13 | 99.50 | 99.30 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.126 | 0.122 | 0.120 | 0.130 | 0.129 | 0.123 | 0.118 | 0.119 | 0.121 | 0.118 | 0.115 | 0.117 |
| Mn | 0.860 | 0.871 | 0.864 | 0.863 | 0.863 | 0.868 | 0.868 | 0.878 | 0.878 | 0.879 | 0.886 | 0.885 |
| Ti | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.000 |
| Nb | 0.872 | 0.831 | 0.953 | 1.088 | 1.257 | 1.251 | 1.121 | 1.208 | 1.209 | 1.191 | 1.268 | 1.148 |
| Ta | 1.122 | 1.161 | 1.045 | 0.906 | 0.736 | 0.739 | 0.870 | 0.779 | 0.781 | 0.798 | 0.720 | 0.837 |
| Sn | 0.001 | 0.002 | 0.002 | 0.001 | 0.000 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 |
| W | 0.005 | 0.006 | 0.005 | 0.006 | 0.006 | 0.007 | 0.007 | 0.008 | 0.007 | 0.006 | 0.007 | 0.008 |
| Pb | 0.002 | 0.001 | 0.003 | 0.003 | 0.004 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 |
| Ca | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Total | 2.995 | 2.997 | 2.992 | 2.998 | 2.997 | 2.997 | 2.995 | 3.000 | 3.001 | 3.001 | 3.002 | 3.005 |
| Mn/(Mn+Fe) | 0.872 | 0.877 | 0.878 | 0.869 | 0.870 | 0.875 | 0.880 | 0.881 | 0.879 | 0.881 | 0.885 | 0.884 |
| Ta/(Ta+Nb) | 0.563 | 0.583 | 0.523 | 0.454 | 0.369 | 0.371 | 0.437 | 0.392 | 0.392 | 0.401 | 0.362 | 0.422 |
| Comments: | traverse along secondary oscillatory zoned edge of crystal HA1 early to HA22 late | | | | | | traverse along secondary oscillatory zoned edge of crystal HA1 early to HA22 late | | | | | |

**East Beryl pegmatite**

93-265J

| | HA13 | HA14 | HA15 | HA16 | HA17 | HA18 | HA19 | HA20 | HA21 | HA22 | HA23 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.03 | 2.12 | 2.00 | 2.03 | 2.06 | 2.14 | 2.18 | 2.10 | 2.26 | 2.75 | 2.87 |
| MnO | 15.11 | 15.01 | 15.05 | 15.04 | 15.00 | 15.06 | 15.08 | 15.25 | 15.05 | 14.73 | 14.38 |
| TiO2 | 0.04 | 0.04 | 0.03 | 0.07 | 0.07 | 0.08 | 0.07 | 0.03 | 0.03 | 0.05 | 0.19 |
| Nb2O5 | 37.19 | 37.90 | 37.28 | 38.58 | 36.53 | 39.54 | 40.19 | 39.74 | 40.36 | 42.45 | 41.08 |
| Ta2O5 | 44.26 | 43.77 | 43.79 | 43.36 | 44.73 | 41.94 | 41.36 | 41.67 | 41.16 | 38.83 | 40.52 |
| SnO2 | 0.03 | 0.01 | 0.07 | 0.03 | 0.03 | 0.04 | 0.07 | 0.00 | 0.03 | 0.06 | 0.05 |
| WO3 | 0.37 | 0.40 | 0.37 | 0.40 | 0.34 | 0.43 | 0.43 | 0.43 | 0.36 | 0.43 | 0.66 |
| PbO | 0.56 | 0.20 | 0.19 | 0.18 | 0.20 | 0.23 | 0.18 | 0.13 | 0.16 | 0.22 | 0.17 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.01 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.14 | 0.00 | 0.11 | 0.04 | 0.00 | 0.00 | 0.08 |
| CaO | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.03 | 0.02 |
| Total | 99.61 | 99.45 | 98.77 | 99.71 | 99.09 | 99.46 | 99.71 | 99.40 | 99.42 | 99.54 | 100.01 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.117 | 0.121 | 0.116 | 0.115 | 0.119 | 0.121 | 0.123 | 0.119 | 0.128 | 0.154 | 0.161 |
| Mn | 0.881 | 0.871 | 0.881 | 0.869 | 0.879 | 0.867 | 0.862 | 0.877 | 0.863 | 0.835 | 0.816 |
| Ti | 0.002 | 0.002 | 0.001 | 0.003 | 0.003 | 0.004 | 0.004 | 0.002 | 0.002 | 0.002 | 0.010 |
| Nb | 1.157 | 1.175 | 1.166 | 1.189 | 1.142 | 1.215 | 1.227 | 1.219 | 1.235 | 1.284 | 1.244 |
| Ta | 0.829 | 0.816 | 0.823 | 0.804 | 0.841 | 0.775 | 0.760 | 0.769 | 0.758 | 0.706 | 0.738 |
| Sn | 0.001 | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | 0.002 | 0.001 |
| W | 0.007 | 0.007 | 0.007 | 0.007 | 0.006 | 0.008 | 0.007 | 0.008 | 0.006 | 0.007 | 0.011 |
| Pb | 0.010 | 0.004 | 0.003 | 0.003 | 0.004 | 0.004 | 0.003 | 0.002 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.006 | 0.002 | 0.000 | 0.000 | 0.005 |
| Ca | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.001 | 0.002 | 0.001 |
| Total | 3.005 | 2.997 | 3.000 | 2.992 | 3.004 | 2.995 | 2.996 | 3.000 | 2.996 | 2.996 | 2.990 |
| Mn/(Mn+Fe) | 0.883 | 0.878 | 0.884 | 0.883 | 0.880 | 0.877 | 0.875 | 0.880 | 0.871 | 0.845 | 0.835 |
| Ta/(Ta+Nb) | 0.417 | 0.410 | 0.414 | 0.403 | 0.424 | 0.390 | 0.382 | 0.387 | 0.380 | 0.355 | 0.372 |

Comments:

**East Beryl pegmatite**

93-265J

| | HB1 | HB2 | HB3 | HB4 | HB5 | HB6 | HB7 | HB8 | HB9 | HB10 | HB11 | HB12 | HB13 | HB14 | HB15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 1.60 | 1.51 | 1.40 | 1.29 | 1.31 | 1.47 | 1.44 | 1.70 | 1.66 | 1.70 | 2.07 | 2.14 | 2.30 | 2.50 | 2.52 |
| MnO | 15.60 | 15.68 | 15.89 | 16.11 | 16.18 | 16.02 | 16.03 | 15.92 | 15.90 | 15.95 | 15.78 | 15.81 | 15.77 | 15.73 | 15.43 |
| TiO2 | 0.18 | 0.17 | 0.18 | 0.20 | 0.19 | 0.16 | 0.18 | 0.20 | 0.19 | 0.18 | 0.21 | 0.29 | 0.26 | 0.25 | 0.25 |
| Nb2O5 | 37.77 | 38.07 | 38.02 | 38.29 | 38.80 | 39.28 | 39.45 | 39.76 | 39.94 | 40.40 | 41.69 | 43.66 | 44.21 | 44.98 | 43.41 |
| Ta2O5 | 43.55 | 43.09 | 42.66 | 41.87 | 41.93 | 41.50 | 40.75 | 40.53 | 39.88 | 39.42 | 38.48 | 35.32 | 34.52 | 34.08 | 35.43 |
| SnO2 | 0.13 | 0.05 | 0.13 | 0.14 | 0.07 | 0.07 | 0.08 | 0.06 | 0.10 | 0.07 | 0.04 | 0.04 | 0.03 | 0.05 | 0.10 |
| WO3 | 0.76 | 0.82 | 0.81 | 0.83 | 0.80 | 0.75 | 0.81 | 0.77 | 0.82 | 0.81 | 0.72 | 0.94 | 0.95 | 0.85 | 0.67 |
| PbO | 0.16 | 0.16 | 0.18 | 0.19 | 0.19 | 0.17 | 0.21 | 0.21 | 0.16 | 0.14 | 0.23 | 0.16 | 0.22 | 0.19 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.02 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 |
| CaO | 0.01 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 | 0.01 |
| Total | 99.77 | 99.61 | 99.28 | 98.95 | 99.50 | 99.53 | 98.96 | 99.15 | 98.78 | 98.69 | 99.23 | 98.45 | 98.29 | 98.64 | 98.05 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.091 | 0.086 | 0.080 | 0.074 | 0.074 | 0.083 | 0.082 | 0.096 | 0.094 | 0.097 | 0.116 | 0.120 | 0.128 | 0.138 | 0.141 |
| Mn | 0.902 | 0.906 | 0.921 | 0.934 | 0.932 | 0.920 | 0.925 | 0.915 | 0.915 | 0.917 | 0.898 | 0.894 | 0.891 | 0.883 | 0.878 |
| Ti | 0.009 | 0.009 | 0.009 | 0.010 | 0.010 | 0.008 | 0.009 | 0.010 | 0.010 | 0.009 | 0.011 | 0.014 | 0.013 | 0.013 | 0.012 |
| Nb | 1.166 | 1.175 | 1.176 | 1.186 | 1.194 | 1.204 | 1.215 | 1.220 | 1.227 | 1.240 | 1.266 | 1.318 | 1.333 | 1.347 | 1.317 |
| Ta | 0.809 | 0.800 | 0.794 | 0.780 | 0.776 | 0.765 | 0.755 | 0.748 | 0.737 | 0.728 | 0.703 | 0.641 | 0.626 | 0.614 | 0.647 |
| Sn | 0.003 | 0.001 | 0.003 | 0.004 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 |
| W | 0.013 | 0.015 | 0.014 | 0.015 | 0.014 | 0.013 | 0.014 | 0.014 | 0.014 | 0.014 | 0.013 | 0.016 | 0.016 | 0.015 | 0.012 |
| Pb | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| Ca | 0.001 | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 |
| Total | 2.998 | 2.998 | 3.003 | 3.008 | 3.006 | 3.006 | 3.006 | 3.009 | 3.010 | 3.010 | 3.011 | 3.012 | 3.014 | 3.015 | 3.015 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.908 | 0.913 | 0.920 | 0.927 | 0.926 | 0.917 | 0.919 | 0.905 | 0.906 | 0.905 | 0.885 | 0.882 | 0.874 | 0.865 | 0.861 |
| Ta/(Ta+Nb) | 0.410 | 0.405 | 0.403 | 0.397 | 0.394 | 0.389 | 0.383 | 0.380 | 0.375 | 0.370 | 0.357 | 0.327 | 0.320 | 0.313 | 0.329 |

Comments: traverse across main (early) part of crystal
HB1 primary core to HB30 patchy zoned opposite edge

**East Beryl pegmatite**

93-265J

| | HB16 | HB17 | HB18 | HB19 | HB20 | HB21 | HB23 | HB24 | HB25 | HB26 | HB27 | HB28 | HB29 | HB30 | HC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.51 | 2.61 | 2.65 | 2.55 | 2.65 | 2.55 | 2.22 | 2.53 | 2.73 | 2.98 | 2.96 | 2.91 | 3.76 | 2.62 | 2.45 |
| MnO | 15.49 | 15.35 | 15.48 | 15.48 | 15.50 | 15.35 | 15.78 | 15.51 | 14.98 | 14.95 | 14.73 | 14.15 | 13.49 | 14.97 | 14.86 |
| TiO2 | 0.28 | 0.25 | 0.26 | 0.26 | 0.27 | 0.05 | 0.03 | 0.18 | 0.19 | 0.19 | 0.20 | 0.29 | 0.29 | 0.22 | 0.16 |
| Nb2O5 | 43.34 | 43.49 | 44.00 | 44.54 | 44.48 | 42.96 | 42.90 | 42.06 | 40.90 | 40.61 | 37.68 | 35.19 | 35.15 | 36.34 | 37.11 |
| Ta2O5 | 35.29 | 35.25 | 34.84 | 34.29 | 34.21 | 36.96 | 36.93 | 37.57 | 38.38 | 38.47 | 41.81 | 44.56 | 45.12 | 43.85 | 43.31 |
| SnO2 | 0.05 | 0.07 | 0.05 | 0.07 | 0.07 | 0.02 | 0.06 | 0.09 | 0.07 | 0.00 | 0.07 | 0.08 | 0.06 | 0.04 | 0.08 |
| WO3 | 0.63 | 0.74 | 0.83 | 0.91 | 0.92 | 0.41 | 0.34 | 0.65 | 0.75 | 0.79 | 0.74 | 0.83 | 0.79 | 0.73 | 0.76 |
| PbO | 0.18 | 0.20 | 0.14 | 0.23 | 0.24 | 0.21 | 0.22 | 0.24 | 0.15 | 0.13 | 0.16 | 0.12 | 0.18 | 0.15 | 0.17 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.03 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.10 | 0.00 | 0.10 | 0.00 | 0.02 | 0.07 | 0.05 | 0.09 | 0.00 | 0.09 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 |
| CaO | 0.03 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.02 | 0.03 | 0.01 | 0.01 |
| Total | 97.91 | 97.97 | 98.35 | 98.35 | 98.37 | 98.59 | 98.54 | 98.92 | 98.20 | 98.26 | 98.38 | 98.22 | 98.86 | 98.94 | 98.91 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.141 | 0.147 | 0.148 | 0.142 | 0.147 | 0.143 | 0.125 | 0.142 | 0.155 | 0.169 | 0.171 | 0.170 | 0.219 | 0.152 | 0.142 |
| Mn | 0.881 | 0.873 | 0.874 | 0.873 | 0.874 | 0.873 | 0.898 | 0.882 | 0.862 | 0.861 | 0.861 | 0.838 | 0.796 | 0.877 | 0.868 |
| Ti | 0.014 | 0.013 | 0.013 | 0.013 | 0.013 | 0.003 | 0.001 | 0.009 | 0.010 | 0.010 | 0.010 | 0.015 | 0.015 | 0.012 | 0.008 |
| Nb | 1.316 | 1.320 | 1.326 | 1.341 | 1.338 | 1.304 | 1.303 | 1.277 | 1.256 | 1.248 | 1.175 | 1.113 | 1.107 | 1.136 | 1.157 |
| Ta | 0.644 | 0.644 | 0.632 | 0.621 | 0.619 | 0.675 | 0.675 | 0.686 | 0.709 | 0.711 | 0.784 | 0.848 | 0.854 | 0.825 | 0.812 |
| Sn | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.000 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 |
| W | 0.011 | 0.013 | 0.014 | 0.016 | 0.016 | 0.007 | 0.006 | 0.011 | 0.013 | 0.014 | 0.013 | 0.015 | 0.014 | 0.013 | 0.014 |
| Pb | 0.003 | 0.004 | 0.002 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 | 0.003 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.000 | 0.006 | 0.000 | 0.001 | 0.004 | 0.003 | 0.005 | 0.000 | 0.005 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 |
| Ca | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 |
| Total | 3.020 | 3.014 | 3.017 | 3.012 | 3.016 | 3.013 | 3.017 | 3.019 | 3.013 | 3.021 | 3.022 | 3.010 | 3.013 | 3.020 | 3.008 |
| Mn/(Mn+Fe) | 0.862 | 0.856 | 0.855 | 0.860 | 0.856 | 0.859 | 0.878 | 0.861 | 0.848 | 0.836 | 0.834 | 0.831 | 0.784 | 0.853 | 0.860 |
| Ta/(Ta+Nb) | 0.329 | 0.328 | 0.323 | 0.316 | 0.316 | 0.341 | 0.341 | 0.349 | 0.361 | 0.363 | 0.400 | 0.432 | 0.436 | 0.421 | 0.412 |

Comments:

| | East Beryl pegmatite | | | East Beryl pegmatite | | | | | | East Beryl pegmatite | | | East Be peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-265N(i) | | | 93-265N(ii) | | | | | | 93-265P | | | 93-265Q | |
| | AA | AB | AC | BB | BC | BD | BE | BF | BJ | WB | WC | WD | JD | JH |
| FeO | 5.69 | 6.65 | 6.89 | 8.97 | 7.71 | 6.79 | 5.19 | 4.85 | 5.80 | 6.48 | 6.00 | 5.66 | 8.57 | 8.43 |
| MnO | 12.45 | 11.66 | 11.43 | 10.57 | 11.63 | 12.60 | 14.31 | 14.75 | 13.25 | 12.80 | 13.10 | 12.51 | 10.86 | 10.04 |
| TiO2 | 0.74 | 0.69 | 0.67 | 0.55 | 0.65 | 0.55 | 0.59 | 0.65 | 0.52 | 0.47 | 0.27 | 0.39 | 0.63 | 0.54 |
| Nb2O5 | 43.28 | 45.48 | 46.16 | 63.74 | 61.61 | 58.64 | 61.35 | 63.37 | 57.73 | 42.29 | 42.83 | 42.74 | 57.83 | 58.32 |
| Ta2O5 | 35.18 | 33.28 | 33.24 | 13.27 | 16.19 | 19.65 | 16.59 | 14.89 | 21.48 | 36.99 | 36.83 | 37.83 | 22.01 | 19.75 |
| SnO2 | 0.22 | 0.17 | 0.20 | 0.11 | 0.10 | 0.14 | 0.08 | 0.13 | 0.16 | 0.22 | 0.19 | 0.11 | 0.10 | 0.11 |
| WO3 | 0.57 | 0.52 | 0.52 | 0.58 | 0.67 | 0.71 | 0.55 | 0.61 | 0.40 | 0.59 | 0.26 | 0.45 | 0.46 | 0.44 |
| PbO | 0.43 | 0.40 | 0.43 | 0.66 | 0.56 | 0.47 | 0.50 | 0.51 | 0.55 | 0.22 | 0.23 | 0.23 | 0.31 | 0.84 |
| ThO2 | 0.06 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.60 |
| Sb2O3 | 0.08 | 0.06 | 0.06 | 0.07 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.06 | 0.05 | 0.06 | 0.03 | 0.03 |
| Bi2O3 | | | | | | | | | | | | | | |
| Sc2O3 | 0.03 | 0.05 | 0.03 | 0.07 | 0.07 | 0.02 | 0.07 | 0.05 | 0.07 | 0.02 | 0.02 | 0.00 | 0.02 | 0.02 |
| CaO | 0.07 | 0.04 | 0.06 | 0.04 | 0.04 | 0.03 | 0.04 | 0.06 | 0.06 | 0.04 | 0.04 | 0.04 | 0.03 | 0.37 |
| Total | 98.80 | 99.00 | 99.70 | 98.68 | 99.29 | 99.65 | 99.32 | 99.92 | 100.07 | 100.18 | 99.82 | 100.03 | 100.88 | 99.49 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.317 | 0.365 | 0.376 | 0.453 | 0.391 | 0.349 | 0.264 | 0.243 | 0.299 | 0.358 | 0.333 | 0.314 | 0.438 | 0.436 |
| Mn | 0.702 | 0.649 | 0.631 | 0.541 | 0.598 | 0.655 | 0.736 | 0.748 | 0.691 | 0.717 | 0.736 | 0.702 | 0.562 | 0.526 |
| Ti | 0.037 | 0.034 | 0.033 | 0.025 | 0.030 | 0.025 | 0.027 | 0.029 | 0.024 | 0.023 | 0.013 | 0.019 | 0.029 | 0.025 |
| Nb | 1.302 | 1.351 | 1.360 | 1.742 | 1.691 | 1.628 | 1.685 | 1.716 | 1.606 | 1.265 | 1.284 | 1.281 | 1.597 | 1.630 |
| Ta | 0.637 | 0.595 | 0.589 | 0.218 | 0.267 | 0.328 | 0.274 | 0.243 | 0.360 | 0.665 | 0.664 | 0.682 | 0.366 | 0.332 |
| Sn | 0.006 | 0.004 | 0.005 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 | 0.004 | 0.006 | 0.005 | 0.003 | 0.002 | 0.003 |
| W | 0.010 | 0.009 | 0.009 | 0.009 | 0.011 | 0.011 | 0.009 | 0.009 | 0.006 | 0.010 | 0.004 | 0.008 | 0.007 | 0.007 |
| Pb | 0.008 | 0.007 | 0.008 | 0.011 | 0.009 | 0.008 | 0.008 | 0.008 | 0.009 | 0.004 | 0.004 | 0.004 | 0.005 | 0.014 |
| Th | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 |
| Sb | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 |
| Bi | | | | | | | | | | | | | | |
| Sc | 0.002 | 0.003 | 0.002 | 0.004 | 0.004 | 0.001 | 0.004 | 0.003 | 0.004 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| Ca | 0.005 | 0.003 | 0.004 | 0.003 | 0.003 | 0.002 | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.003 | 0.002 | 0.025 |
| Total | 3.027 | 3.022 | 3.018 | 3.011 | 3.007 | 3.013 | 3.013 | 3.008 | 3.008 | 3.054 | 3.049 | 3.017 | 3.010 | 3.006 |
| | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.689 | 0.640 | 0.627 | 0.544 | 0.604 | 0.653 | 0.736 | 0.755 | 0.698 | 0.667 | 0.689 | 0.691 | 0.562 | 0.547 |
| Ta/(Ta+Nb) | 0.328 | 0.306 | 0.302 | 0.111 | 0.136 | 0.168 | 0.140 | 0.124 | 0.183 | 0.345 | 0.341 | 0.347 | 0.186 | 0.169 |
| | | | | | | | | | | | | | | |
| Comments: | AA - AC<br>same grain | | | BB & BC<br>same grain | | | | | | | WC & WD<br>same grain | | | |

| | East Beryl pegmatite | | | | | Audrey's pegmatite | | | | Lou's pegmatite | | | Lou's pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-265Ri | | | | | 93-271 | | | | 93-272A | | | 93-272B | | | | |
| | MB | MC | MD | DJ | DN | YB | QB | YF | YG | QC | QD | QI | XB | XC | XD | CA1 | CA2 |
| FeO | 2.30 | 2.25 | 2.47 | 2.35 | 2.49 | 12.19 | 12.43 | 12.33 | 12.16 | 9.83 | 9.67 | 9.29 | 11.22 | 11.60 | 10.04 | 10.07 | 9.95 |
| MnO | 13.99 | 13.77 | 13.49 | 13.22 | 13.23 | 4.76 | 4.98 | 4.09 | 3.93 | 8.16 | 6.88 | 7.75 | 7.04 | 6.15 | 6.73 | 6.25 | 6.34 |
| TiO2 | 0.30 | 0.33 | 0.37 | 0.12 | 0.17 | 1.17 | 1.13 | 1.70 | 1.43 | 1.98 | 1.12 | 1.62 | 1.42 | 2.05 | 1.56 | 1.05 | 0.93 |
| Nb2O5 | 20.94 | 19.64 | 19.52 | 20.94 | 21.78 | 37.40 | 40.35 | 31.85 | 31.83 | 45.81 | 26.06 | 36.61 | 48.71 | 45.34 | 28.69 | 26.41 | 25.95 |
| Ta2O5 | 61.21 | 62.55 | 63.09 | 62.22 | 61.83 | 40.45 | 38.80 | 48.16 | 46.31 | 32.85 | 56.32 | 43.30 | 31.11 | 32.93 | 51.46 | 54.42 | 56.12 |
| SnO2 | 0.18 | 0.00 | 0.00 | 0.21 | 0.07 | 0.34 | 0.16 | 0.56 | 0.63 | 0.57 | 0.32 | 0.39 | 0.24 | 0.47 | 1.19 | 0.37 | 0.54 |
| WO3 | 0.15 | 0.25 | 0.18 | 0.45 | 0.49 | 1.01 | 1.79 | 0.15 | 1.19 | 0.60 | 0.24 | 0.45 | 0.44 | 0.66 | 0.55 | 0.65 | 0.62 |
| PbO | 0.21 | 0.15 | 0.10 | 0.06 | 0.07 | 0.44 | 0.13 | 0.37 | 0.29 | 0.26 | 0.13 | 0.17 | 0.22 | 0.21 | 0.08 | 0.11 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.18 | 0.00 | 0.10 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.06 | 0.05 | 0.08 | 0.00 | 0.02 | 0.08 | 0.00 | 0.08 | 0.06 | | | | | | | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | | | 0.00 | 0.03 |
| Sc2O3 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.32 | 0.13 | 0.49 | 0.32 | | | | | | | 0.00 | 0.20 |
| CaO | 0.00 | 0.00 | 0.00 | 0.04 | 0.03 | 0.25 | 0.01 | 0.16 | 0.64 | 0.12 | 0.05 | 0.04 | 0.04 | 0.04 | 0.05 | 0.01 | 0.00 |
| Total | 99.37 | 99.04 | 99.35 | 99.63 | 100.20 | 98.59 | 99.92 | 100.06 | 98.90 | 100.20 | 100.79 | 99.63 | 100.44 | 99.44 | 100.36 | 99.35 | 100.77 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | |
| Fe | 0.144 | 0.143 | 0.156 | 0.148 | 0.155 | 0.697 | 0.693 | 0.714 | 0.711 | 0.528 | 0.579 | 0.528 | 0.597 | 0.629 | 0.590 | 0.609 | 0.596 |
| Mn | 0.890 | 0.885 | 0.865 | 0.841 | 0.833 | 0.276 | 0.281 | 0.240 | 0.233 | 0.444 | 0.417 | 0.446 | 0.379 | 0.338 | 0.401 | 0.383 | 0.385 |
| Ti | 0.017 | 0.019 | 0.021 | 0.007 | 0.010 | 0.060 | 0.057 | 0.089 | 0.075 | 0.096 | 0.060 | 0.083 | 0.068 | 0.100 | 0.083 | 0.057 | 0.050 |
| Nb | 0.711 | 0.674 | 0.668 | 0.711 | 0.732 | 1.156 | 1.215 | 0.997 | 1.006 | 1.331 | 0.843 | 1.124 | 1.401 | 1.328 | 0.912 | 0.863 | 0.840 |
| Ta | 1.250 | 1.291 | 1.299 | 1.270 | 1.250 | 0.752 | 0.703 | 0.907 | 0.881 | 0.574 | 1.096 | 0.800 | 0.538 | 0.580 | 0.984 | 1.070 | 1.093 |
| Sn | 0.005 | 0.000 | 0.000 | 0.006 | 0.002 | 0.009 | 0.004 | 0.015 | 0.018 | 0.015 | 0.009 | 0.011 | 0.006 | 0.012 | 0.033 | 0.011 | 0.015 |
| W | 0.003 | 0.005 | 0.004 | 0.009 | 0.009 | 0.018 | 0.031 | 0.003 | 0.022 | 0.010 | 0.004 | 0.008 | 0.007 | 0.011 | 0.010 | 0.012 | 0.011 |
| Pb | 0.004 | 0.003 | 0.002 | 0.001 | 0.001 | 0.008 | 0.002 | 0.007 | 0.005 | 0.004 | 0.003 | 0.003 | 0.004 | 0.004 | 0.001 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.002 | 0.002 | | | | | | | 0.000 | 0.000 |
| Bi | | | | | | | | | | | | | | | | 0.000 | 0.001 |
| Sc | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.019 | 0.008 | 0.030 | 0.019 | | | | | | | 0.000 | 0.013 |
| Ca | 0.000 | 0.000 | 0.000 | 0.003 | 0.002 | 0.018 | 0.001 | 0.012 | 0.048 | 0.008 | 0.004 | 0.003 | 0.003 | 0.002 | 0.004 | 0.001 | 0.000 |
| Total | 3.029 | 3.023 | 3.019 | 2.997 | 2.996 | 3.019 | 2.995 | 3.017 | 3.021 | 3.011 | 3.014 | 3.005 | 3.003 | 3.003 | 3.019 | 3.008 | 3.006 |
| Mn/(Mn+Fe) | 0.860 | 0.861 | 0.847 | 0.851 | 0.843 | 0.283 | 0.289 | 0.251 | 0.247 | 0.457 | 0.419 | 0.458 | 0.389 | 0.349 | 0.404 | 0.386 | 0.392 |
| Ta/(Ta+Nb) | 0.637 | 0.657 | 0.660 | 0.641 | 0.631 | 0.394 | 0.366 | 0.476 | 0.467 | 0.301 | 0.565 | 0.416 | 0.278 | 0.304 | 0.519 | 0.553 | 0.565 |
| Comments: | MB - DN | | | | | YB & QB | | YF & YG | | QC & QD in cluster | | | isolated grains | | | CA traverse 570 µm | |
| | same grain | | | | | same grain | | same grain | | | | | later than cass. | | | rim | |
| | | | | | | unzoned grains | | | | | | | | | | | |

**Lou's pegmatite**

**93-272B**

| | CA3 | CA4 | CA5 | CA6 | CA7 | CA8 | CA9 | CA10 | CA11 | CA12 | CA13 | CA14 | CA15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 9.91 | 9.90 | 9.95 | 9.97 | 9.73 | 9.83 | 9.85 | 9.84 | 9.78 | 10.08 | 10.25 | 10.17 | 10.25 |
| MnO | 6.35 | 6.38 | 6.38 | 6.49 | 6.68 | 6.69 | 6.63 | 6.62 | 6.56 | 6.42 | 6.37 | 6.27 | 6.18 |
| TiO2 | 0.95 | 1.09 | 1.09 | 1.35 | 0.95 | 1.40 | 1.28 | 1.06 | 1.16 | 1.04 | 0.98 | 1.05 | 1.32 |
| Nb2O5 | 25.56 | 25.88 | 26.09 | 28.18 | 25.95 | 29.60 | 27.64 | 26.30 | 26.06 | 27.28 | 29.23 | 27.19 | 27.07 |
| Ta2O5 | 55.19 | 54.83 | 54.50 | 52.42 | 55.31 | 50.81 | 52.11 | 55.29 | 54.80 | 53.91 | 51.61 | 53.84 | 53.20 |
| SnO2 | 0.85 | 0.79 | 0.86 | 0.84 | 0.40 | 0.68 | 0.62 | 0.37 | 0.48 | 0.47 | 0.27 | 0.29 | 0.55 |
| WO3 | 0.55 | 0.75 | 0.75 | 0.81 | 0.69 | 0.86 | 0.80 | 0.73 | 0.66 | 0.74 | 0.72 | 0.72 | 0.78 |
| PbO | 0.12 | 0.05 | 0.12 | 0.17 | 0.11 | 0.09 | 0.19 | 0.14 | 0.09 | 0.21 | 0.13 | 0.24 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.08 | 0.14 | 0.07 | 0.14 | 0.00 | 0.05 | 0.11 | 0.00 | 0.13 | 0.10 | 0.00 | 0.01 |
| CaO | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 |
| Total | 99.63 | 99.76 | 99.89 | 100.30 | 99.99 | 99.98 | 99.18 | 100.47 | 99.60 | 100.27 | 99.66 | 99.77 | 99.50 |
| | | | | | | | | | | | | | |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.601 | 0.597 | 0.599 | 0.590 | 0.587 | 0.579 | 0.591 | 0.589 | 0.591 | 0.601 | 0.609 | 0.610 | 0.615 |
| Mn | 0.389 | 0.390 | 0.389 | 0.389 | 0.408 | 0.399 | 0.403 | 0.401 | 0.401 | 0.388 | 0.383 | 0.381 | 0.375 |
| Ti | 0.052 | 0.059 | 0.059 | 0.072 | 0.052 | 0.074 | 0.069 | 0.057 | 0.063 | 0.056 | 0.053 | 0.057 | 0.071 |
| Nb | 0.837 | 0.844 | 0.849 | 0.902 | 0.846 | 0.942 | 0.896 | 0.851 | 0.850 | 0.880 | 0.938 | 0.882 | 0.878 |
| Ta | 1.087 | 1.075 | 1.066 | 1.009 | 1.084 | 0.973 | 1.016 | 1.076 | 1.076 | 1.046 | 0.996 | 1.051 | 1.038 |
| Sn | 0.025 | 0.023 | 0.025 | 0.024 | 0.012 | 0.019 | 0.018 | 0.011 | 0.014 | 0.013 | 0.008 | 0.008 | 0.016 |
| W | 0.010 | 0.014 | 0.014 | 0.015 | 0.013 | 0.016 | 0.015 | 0.014 | 0.012 | 0.014 | 0.013 | 0.013 | 0.014 |
| Pb | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.002 | 0.004 | 0.003 | 0.002 | 0.004 | 0.002 | 0.005 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.008 | 0.005 | 0.009 | 0.004 | 0.009 | 0.000 | 0.003 | 0.007 | 0.000 | 0.008 | 0.006 | 0.000 | 0.001 |
| Ca | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.012 | 3.009 | 3.011 | 3.007 | 3.012 | 3.003 | 3.014 | 3.010 | 3.009 | 3.011 | 3.008 | 3.008 | 3.011 |
| | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.393 | 0.395 | 0.393 | 0.398 | 0.410 | 0.408 | 0.405 | 0.405 | 0.405 | 0.392 | 0.386 | 0.384 | 0.379 |
| Ta/(Ta+Nb) | 0.565 | 0.560 | 0.557 | 0.528 | 0.562 | 0.508 | 0.531 | 0.558 | 0.559 | 0.543 | 0.515 | 0.544 | 0.542 |

Comments: CA traverse 570 μm core

(along length of elongate grain)

| | Lou's pegmatite | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-272B | | | | | | | | | | | |
| | CA16 | CA17 | CA18 | CA19 | CA20 | CA21 | CA22 | CA23 | CA24 | CA25 | CA26 | CC |
| FeO | 10.09 | 9.67 | 9.72 | 9.75 | 10.05 | 10.01 | 10.15 | 10.21 | 10.13 | 10.34 | 10.24 | 10.06 |
| MnO | 6.19 | 6.27 | 6.76 | 6.59 | 6.64 | 6.48 | 6.27 | 6.19 | 6.13 | 6.26 | 6.10 | 6.45 |
| TiO2 | 1.37 | 1.04 | 1.16 | 1.16 | 1.43 | 1.11 | 1.07 | 1.05 | 1.08 | 1.03 | 0.97 | 1.47 |
| Nb2O5 | 26.28 | 25.36 | 26.63 | 27.62 | 30.16 | 25.78 | 26.28 | 26.86 | 26.06 | 29.22 | 27.37 | 29.39 |
| Ta2O5 | 53.90 | 54.93 | 54.56 | 53.23 | 49.73 | 55.31 | 55.31 | 54.18 | 54.98 | 52.02 | 54.55 | 50.77 |
| SnO2 | 0.72 | 1.02 | 0.38 | 0.74 | 0.50 | 0.47 | 0.48 | 0.50 | 0.59 | 0.33 | 0.34 | 0.73 |
| WO3 | 0.79 | 0.69 | 0.79 | 0.77 | 0.88 | 0.71 | 0.68 | 0.64 | 0.74 | 0.71 | 0.42 | 0.83 |
| PbO | 0.09 | 0.17 | 0.12 | 0.09 | 0.16 | 0.11 | 0.04 | 0.12 | 0.02 | 0.13 | 0.09 | 0.16 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.04 | 0.09 | 0.07 | 0.01 | 0.05 | 0.15 | 0.12 | 0.10 | 0.08 | 0.03 | 0.26 | 0.00 |
| CaO | 0.01 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 |
| Total | 99.47 | 99.25 | 100.20 | 99.99 | 99.62 | 100.14 | 100.40 | 99.86 | 99.81 | 100.10 | 100.36 | 99.87 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.607 | 0.588 | 0.582 | 0.581 | 0.592 | 0.602 | 0.608 | 0.612 | 0.610 | 0.612 | 0.610 | 0.593 |
| Mn | 0.377 | 0.386 | 0.409 | 0.398 | 0.396 | 0.395 | 0.381 | 0.376 | 0.374 | 0.375 | 0.368 | 0.385 |
| Ti | 0.074 | 0.057 | 0.062 | 0.062 | 0.076 | 0.060 | 0.057 | 0.057 | 0.058 | 0.055 | 0.052 | 0.078 |
| Nb | 0.855 | 0.834 | 0.862 | 0.890 | 0.959 | 0.838 | 0.851 | 0.871 | 0.849 | 0.934 | 0.882 | 0.937 |
| Ta | 1.055 | 1.087 | 1.062 | 1.032 | 0.952 | 1.082 | 1.077 | 1.057 | 1.077 | 1.001 | 1.057 | 0.974 |
| Sn | 0.021 | 0.030 | 0.011 | 0.021 | 0.014 | 0.014 | 0.014 | 0.014 | 0.017 | 0.009 | 0.010 | 0.020 |
| W | 0.015 | 0.013 | 0.015 | 0.014 | 0.016 | 0.013 | 0.013 | 0.012 | 0.014 | 0.013 | 0.008 | 0.015 |
| Pb | 0.002 | 0.003 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 | 0.002 | 0.000 | 0.003 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.006 | 0.004 | 0.001 | 0.003 | 0.009 | 0.008 | 0.006 | 0.005 | 0.002 | 0.016 | 0.000 |
| Ca | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| Total | 3.009 | 3.004 | 3.010 | 3.004 | 3.010 | 3.015 | 3.008 | 3.009 | 3.005 | 3.006 | 3.006 | 3.006 |
| Mn/(Mn+Fe) | 0.383 | 0.396 | 0.413 | 0.406 | 0.401 | 0.396 | 0.385 | 0.380 | 0.380 | 0.380 | 0.377 | 0.393 |
| Ta/(Ta+Nb) | 0.552 | 0.566 | 0.552 | 0.537 | 0.498 | 0.563 | 0.559 | 0.548 | 0.559 | 0.517 | 0.545 | 0.510 |
| Comments: | | | | | | | | | | | rim | |

**Lou's pegmatite**

93-272B

| | CD1 | CD2 | CD3 | CD4 | CD5 | CD6 | CD7 | CD8 | CD9 | CD10 | CD11 | CD12 | CD13 | CD14 | CD15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.08 | 10.26 | 10.64 | 10.99 | 10.69 | 10.76 | 10.99 | 10.45 | 10.93 | 10.89 | 11.06 | 11.35 | 11.33 | 11.41 | 11.39 |
| MnO | 6.18 | 6.18 | 6.36 | 6.66 | 6.46 | 6.58 | 6.68 | 6.42 | 6.86 | 6.70 | 6.69 | 6.69 | 6.69 | 6.66 | 6.68 |
| TiO2 | 1.09 | 1.08 | 1.15 | 1.35 | 1.26 | 1.38 | 1.12 | 1.12 | 1.14 | 1.14 | 1.43 | 1.62 | 1.58 | 1.64 | 1.59 |
| Nb2O5 | 25.97 | 27.21 | 33.37 | 41.87 | 36.43 | 40.76 | 42.39 | 33.77 | 43.97 | 40.93 | 44.20 | 48.24 | 47.78 | 48.60 | 48.68 |
| Ta2O5 | 54.61 | 53.39 | 47.41 | 37.34 | 43.68 | 39.33 | 37.13 | 47.01 | 36.07 | 40.04 | 34.80 | 30.24 | 30.45 | 29.78 | 29.66 |
| SnO2 | 0.37 | 0.29 | 0.36 | 0.35 | 0.31 | 0.36 | 0.28 | 0.25 | 0.20 | 0.25 | 0.26 | 0.41 | 0.42 | 0.49 | 0.46 |
| WO3 | 0.74 | 0.77 | 0.81 | 0.77 | 0.66 | 0.65 | 0.56 | 0.56 | 0.70 | 0.63 | 0.70 | 0.75 | 0.81 | 0.77 | 0.75 |
| PbO | 0.08 | 0.15 | 0.18 | 0.25 | 0.13 | 0.18 | 0.15 | 0.14 | 0.20 | 0.14 | 0.22 | 0.26 | 0.33 | 0.21 | 0.23 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.08 | 0.18 | 0.12 | 0.25 | 0.25 | 0.02 | 0.22 | 0.17 | 0.26 | 0.06 | 0.12 | 0.19 | 0.30 | 0.13 | 0.20 |
| CaO | 0.02 | 0.02 | 0.00 | 0.00 | 0.02 | 0.05 | 0.04 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Total | 99.22 | 99.53 | 100.39 | 99.84 | 99.89 | 100.08 | 99.56 | 99.93 | 100.33 | 100.79 | 99.48 | 99.76 | 99.69 | 99.70 | 99.67 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.611 | 0.615 | 0.613 | 0.607 | 0.607 | 0.597 | 0.608 | 0.603 | 0.596 | 0.602 | 0.606 | 0.606 | 0.607 | 0.609 | 0.608 |
| Mn | 0.379 | 0.376 | 0.371 | 0.372 | 0.372 | 0.370 | 0.374 | 0.375 | 0.379 | 0.375 | 0.371 | 0.362 | 0.363 | 0.360 | 0.361 |
| Ti | 0.059 | 0.058 | 0.060 | 0.067 | 0.064 | 0.069 | 0.056 | 0.058 | 0.056 | 0.057 | 0.070 | 0.078 | 0.076 | 0.079 | 0.076 |
| Nb | 0.851 | 0.883 | 1.039 | 1.250 | 1.119 | 1.223 | 1.267 | 1.054 | 1.297 | 1.223 | 1.308 | 1.393 | 1.384 | 1.402 | 1.404 |
| Ta | 1.076 | 1.042 | 0.888 | 0.671 | 0.807 | 0.710 | 0.668 | 0.882 | 0.640 | 0.720 | 0.620 | 0.525 | 0.531 | 0.517 | 0.515 |
| Sn | 0.011 | 0.008 | 0.010 | 0.009 | 0.008 | 0.010 | 0.007 | 0.007 | 0.005 | 0.007 | 0.007 | 0.010 | 0.011 | 0.013 | 0.012 |
| W | 0.014 | 0.014 | 0.014 | 0.013 | 0.012 | 0.011 | 0.010 | 0.010 | 0.012 | 0.011 | 0.012 | 0.012 | 0.013 | 0.013 | 0.012 |
| Pb | 0.002 | 0.003 | 0.003 | 0.005 | 0.002 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.004 | 0.004 | 0.006 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.011 | 0.007 | 0.015 | 0.015 | 0.001 | 0.013 | 0.010 | 0.015 | 0.003 | 0.007 | 0.011 | 0.016 | 0.007 | 0.011 |
| Ca | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.009 | 3.012 | 3.007 | 3.009 | 3.008 | 2.998 | 3.009 | 3.005 | 3.003 | 3.000 | 3.004 | 3.003 | 3.006 | 3.002 | 3.004 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.383 | 0.379 | 0.377 | 0.380 | 0.380 | 0.382 | 0.381 | 0.384 | 0.389 | 0.384 | 0.380 | 0.374 | 0.374 | 0.372 | 0.373 |
| Ta/(Ta+Nb) | 0.558 | 0.541 | 0.461 | 0.349 | 0.419 | 0.367 | 0.345 | 0.456 | 0.330 | 0.370 | 0.321 | 0.274 | 0.277 | 0.269 | 0.268 |

Comments: CD and CE traverses on same patchily zoned grain
CD traverse 240 µm
patchy zonation masks any primary zonation

**Lou's pegmatite**

93-272B

| | CD16 | CD17 | CD18 | CD19 | CD20 | CD21 | CD22 | CE1 | CE2 | CE3 | CE4 | CE5 | CE6 | CE7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 11.21 | 11.10 | 11.13 | 11.16 | 11.11 | 10.82 | 10.34 | 9.91 | 10.74 | 10.89 | 10.88 | 10.80 | 10.31 | 10.43 |
| MnO | 6.87 | 6.71 | 6.93 | 7.01 | 6.85 | 6.62 | 6.48 | 6.34 | 6.62 | 6.76 | 7.02 | 6.68 | 6.35 | 7.12 |
| TiO2 | 1.48 | 1.10 | 1.21 | 1.23 | 1.22 | 1.14 | 1.10 | 0.96 | 1.37 | 1.04 | 1.09 | 1.22 | 1.10 | 1.02 |
| Nb2O5 | 47.14 | 41.94 | 46.20 | 45.05 | 45.55 | 39.83 | 32.51 | 27.03 | 40.13 | 41.37 | 45.91 | 40.64 | 32.66 | 40.45 |
| Ta2O5 | 32.42 | 37.70 | 33.27 | 34.24 | 33.55 | 40.49 | 48.30 | 54.39 | 39.69 | 38.12 | 33.60 | 38.85 | 48.67 | 39.49 |
| SnO2 | 0.35 | 0.24 | 0.23 | 0.30 | 0.27 | 0.26 | 0.31 | 0.30 | 0.42 | 0.25 | 0.24 | 0.22 | 0.25 | 0.22 |
| WO3 | 0.75 | 0.57 | 0.75 | 0.67 | 0.65 | 0.62 | 0.60 | 0.63 | 0.79 | 0.57 | 0.70 | 0.66 | 0.57 | 0.58 |
| PbO | 0.19 | 0.22 | 0.23 | 0.23 | 0.28 | 0.25 | 0.15 | 0.08 | 0.22 | 0.25 | 0.27 | 0.26 | 0.20 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.14 | 0.21 | 0.22 | 0.06 | 0.17 | 0.00 | 0.08 | 0.27 | 0.05 | 0.22 | 0.17 | 0.20 | 0.04 |
| CaO | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | 0.01 | 0.01 | 0.01 |
| Total | 100.48 | 99.74 | 100.17 | 100.11 | 99.55 | 100.23 | 99.81 | 99.74 | 100.26 | 99.33 | 99.93 | 99.52 | 100.32 | 99.55 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.600 | 0.615 | 0.601 | 0.606 | 0.605 | 0.604 | 0.602 | 0.595 | 0.596 | 0.608 | 0.590 | 0.603 | 0.597 | 0.584 |
| Mn | 0.372 | 0.377 | 0.379 | 0.385 | 0.378 | 0.374 | 0.382 | 0.386 | 0.372 | 0.382 | 0.386 | 0.378 | 0.373 | 0.404 |
| Ti | 0.071 | 0.055 | 0.059 | 0.060 | 0.060 | 0.057 | 0.058 | 0.052 | 0.068 | 0.052 | 0.053 | 0.061 | 0.057 | 0.051 |
| Nb | 1.364 | 1.256 | 1.348 | 1.322 | 1.342 | 1.202 | 1.024 | 0.878 | 1.205 | 1.249 | 1.346 | 1.227 | 1.023 | 1.225 |
| Ta | 0.564 | 0.679 | 0.584 | 0.604 | 0.594 | 0.735 | 0.915 | 1.063 | 0.717 | 0.692 | 0.593 | 0.705 | 0.917 | 0.719 |
| Sn | 0.009 | 0.006 | 0.006 | 0.008 | 0.007 | 0.007 | 0.009 | 0.009 | 0.011 | 0.007 | 0.006 | 0.006 | 0.007 | 0.006 |
| W | 0.012 | 0.010 | 0.013 | 0.011 | 0.011 | 0.011 | 0.011 | 0.012 | 0.014 | 0.010 | 0.012 | 0.011 | 0.010 | 0.010 |
| Pb | 0.003 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 | 0.003 | 0.002 | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.008 | 0.012 | 0.013 | 0.003 | 0.010 | 0.000 | 0.005 | 0.016 | 0.003 | 0.013 | 0.010 | 0.012 | 0.003 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.001 | 0.001 |
| Total | 3.001 | 3.011 | 3.006 | 3.014 | 3.006 | 3.005 | 3.004 | 3.002 | 3.003 | 3.009 | 3.003 | 3.007 | 3.000 | 3.006 |
| Mn/(Mn+Fe) | 0.383 | 0.380 | 0.387 | 0.389 | 0.385 | 0.383 | 0.388 | 0.393 | 0.384 | 0.386 | 0.395 | 0.385 | 0.384 | 0.409 |
| Ta/(Ta+Nb) | 0.293 | 0.351 | 0.302 | 0.314 | 0.307 | 0.379 | 0.472 | 0.548 | 0.373 | 0.357 | 0.306 | 0.365 | 0.473 | 0.370 |

Comments: CD and CE traverses on same patchily zoned grain
CD traverse 240 μm
patchy zonation masks any primary zonation

**Lou's pegmatite**

93-272B

| | CE8 | CE9 | CE10 | CE11 | CE12 | CE13 | CE14 | CE15 | CE16 | CE17 | CE18 | CF | CG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.93 | 10.69 | 10.62 | 11.06 | 10.72 | 11.12 | 10.61 | 10.68 | 10.51 | 10.60 | 10.39 | 10.27 | 10.58 |
| MnO | 6.99 | 7.01 | 6.71 | 7.11 | 6.63 | 7.01 | 6.50 | 6.45 | 6.36 | 6.50 | 6.46 | 6.69 | 6.32 |
| TiO2 | 1.18 | 1.14 | 1.11 | 1.06 | 1.14 | 1.09 | 1.11 | 1.14 | 1.12 | 1.10 | 1.08 | 1.03 | 1.03 |
| Nb2O5 | 45.46 | 42.93 | 38.74 | 45.79 | 37.85 | 47.05 | 35.97 | 36.58 | 34.36 | 36.87 | 34.29 | 34.36 | 31.51 |
| Ta2O5 | 34.33 | 36.70 | 41.80 | 33.39 | 42.58 | 32.69 | 44.47 | 44.64 | 46.80 | 44.38 | 46.45 | 47.09 | 50.13 |
| SnO2 | 0.23 | 0.29 | 0.20 | 0.25 | 0.24 | 0.24 | 0.27 | 0.30 | 0.25 | 0.25 | 0.29 | 0.26 | 0.29 |
| WO3 | 0.63 | 0.63 | 0.64 | 0.62 | 0.61 | 0.52 | 0.53 | 0.55 | 0.48 | 0.49 | 0.49 | 0.42 | 0.35 |
| PbO | 0.24 | 0.23 | 0.22 | 0.22 | 0.23 | 0.25 | 0.21 | 0.18 | 0.19 | 0.21 | 0.18 | 0.15 | 0.20 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| Sc2O3 | 0.21 | 0.18 | 0.18 | 0.21 | 0.10 | 0.20 | 0.08 | 0.13 | 0.13 | 0.12 | 0.17 | 0.24 | 0.09 |
| CaO | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 |
| Total | 100.22 | 99.81 | 100.22 | 99.71 | 100.10 | 100.17 | 99.75 | 100.67 | 100.23 | 100.53 | 99.80 | 100.54 | 100.51 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.593 | 0.589 | 0.596 | 0.601 | 0.605 | 0.599 | 0.607 | 0.604 | 0.604 | 0.600 | 0.599 | 0.589 | 0.617 |
| Mn | 0.384 | 0.391 | 0.382 | 0.391 | 0.379 | 0.382 | 0.376 | 0.370 | 0.370 | 0.373 | 0.377 | 0.388 | 0.373 |
| Ti | 0.057 | 0.057 | 0.056 | 0.052 | 0.058 | 0.053 | 0.057 | 0.058 | 0.058 | 0.056 | 0.056 | 0.053 | 0.054 |
| Nb | 1.332 | 1.278 | 1.176 | 1.345 | 1.155 | 1.369 | 1.112 | 1.119 | 1.067 | 1.128 | 1.069 | 1.064 | 0.992 |
| Ta | 0.605 | 0.657 | 0.763 | 0.590 | 0.782 | 0.572 | 0.827 | 0.821 | 0.874 | 0.817 | 0.871 | 0.878 | 0.950 |
| Sn | 0.006 | 0.008 | 0.005 | 0.006 | 0.007 | 0.006 | 0.007 | 0.008 | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 |
| W | 0.010 | 0.011 | 0.011 | 0.010 | 0.011 | 0.009 | 0.009 | 0.010 | 0.009 | 0.009 | 0.009 | 0.007 | 0.006 |
| Pb | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Sc | 0.012 | 0.011 | 0.010 | 0.012 | 0.006 | 0.011 | 0.005 | 0.008 | 0.008 | 0.007 | 0.010 | 0.014 | 0.005 |
| Ca | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 |
| Total | 3.004 | 3.005 | 3.003 | 3.012 | 3.006 | 3.006 | 3.006 | 3.001 | 3.002 | 3.000 | 3.003 | 3.004 | 3.009 |
| Mn/(Mn+Fe) | 0.393 | 0.399 | 0.390 | 0.394 | 0.385 | 0.390 | 0.383 | 0.379 | 0.380 | 0.383 | 0.386 | 0.397 | 0.377 |
| Ta/(Ta+Nb) | 0.312 | 0.340 | 0.394 | 0.305 | 0.404 | 0.295 | 0.426 | 0.423 | 0.450 | 0.420 | 0.449 | 0.452 | 0.489 |

Comments: CD and CE traverses on same patchily zoned grain

CD traverse 240 µm

patchy zonation masks any primary zonation

| | Lou's pegmatite | | | | Lou's pegmatite | | | | | | James' peg. | | James' peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-272D | | | | 93-272E | | | | | | 93-276B | | 93-276B | |
| | PG | PI | PK | PL | MA | MD | ME | JA | JB | JC | SL | SM | SQ | ST |
| FeO | 9.58 | 10.37 | 10.84 | 11.27 | 10.60 | 13.25 | 12.76 | 12.00 | 12.43 | 12.29 | 11.01 | 10.82 | 10.98 | 10.95 |
| MnO | 6.36 | 5.53 | 6.08 | 5.80 | 6.86 | 6.23 | 6.68 | 5.32 | 6.41 | 6.38 | 5.51 | 5.63 | 5.94 | 5.06 |
| TiO2 | 0.84 | 0.85 | 1.09 | 1.75 | 1.23 | 1.35 | 1.36 | 1.53 | 1.42 | 1.44 | 1.95 | 1.81 | 2.23 | 1.71 |
| Nb2O5 | 21.11 | 23.54 | 34.64 | 39.72 | 54.16 | 52.34 | 53.98 | 48.10 | 48.76 | 48.21 | 24.09 | 21.23 | 24.18 | 22.51 |
| Ta2O5 | 59.30 | 58.06 | 46.35 | 37.72 | 25.63 | 24.82 | 24.20 | 31.00 | 30.27 | 30.41 | 53.42 | 55.36 | 53.14 | 54.16 |
| SnO2 | 0.81 | 0.46 | 0.39 | 0.55 | 0.22 | 0.27 | 0.28 | 0.47 | 0.35 | 0.40 | 2.00 | 3.95 | 2.48 | 3.32 |
| WO3 | 0.01 | 0.08 | 0.35 | 0.65 | 0.33 | 0.37 | 0.34 | 0.41 | 0.22 | 0.31 | 0.84 | 0.57 | 0.95 | 0.91 |
| PbO | 0.17 | 0.15 | 0.32 | 0.42 | 0.24 | 0.34 | 0.36 | 0.33 | 0.22 | 0.27 | 0.13 | 0.15 | 0.15 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.08 | 0.11 | 0.14 | 0.11 | 0.00 | 0.10 | 0.08 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.08 | 0.08 | 0.08 | 0.08 | | | | 0.00 | 0.03 | 0.06 | | | | |
| Bi2O3 | | | | | | | | | | | | | | |
| Sc2O3 | 0.06 | 0.08 | 0.15 | 0.18 | | | | 0.00 | 0.19 | 0.19 | | | | |
| CaO | 0.07 | 0.07 | 0.10 | 0.08 | 0.03 | 0.04 | 0.06 | 0.00 | 0.04 | 0.04 | 0.05 | 0.08 | 0.11 | 0.13 |
| Total | 98.47 | 99.38 | 100.54 | 98.33 | 99.30 | 99.13 | 100.10 | 99.16 | 100.16 | 99.84 | 99.00 | 99.60 | 100.16 | 98.87 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.603 | 0.639 | 0.621 | 0.636 | 0.556 | 0.699 | 0.663 | 0.647 | 0.662 | 0.658 | 0.668 | 0.663 | 0.657 | 0.672 |
| Mn | 0.405 | 0.345 | 0.353 | 0.331 | 0.364 | 0.333 | 0.352 | 0.291 | 0.346 | 0.346 | 0.339 | 0.349 | 0.360 | 0.314 |
| Ti | 0.048 | 0.047 | 0.056 | 0.089 | 0.058 | 0.064 | 0.064 | 0.074 | 0.068 | 0.069 | 0.106 | 0.100 | 0.120 | 0.094 |
| Nb | 0.718 | 0.784 | 1.073 | 1.211 | 1.535 | 1.493 | 1.517 | 1.402 | 1.404 | 1.395 | 0.790 | 0.703 | 0.782 | 0.746 |
| Ta | 1.213 | 1.163 | 0.863 | 0.692 | 0.437 | 0.426 | 0.409 | 0.544 | 0.524 | 0.529 | 1.054 | 1.103 | 1.033 | 1.080 |
| Sn | 0.024 | 0.014 | 0.011 | 0.015 | 0.006 | 0.007 | 0.007 | 0.012 | 0.009 | 0.010 | 0.058 | 0.115 | 0.071 | 0.097 |
| W | 0.000 | 0.002 | 0.006 | 0.011 | 0.005 | 0.006 | 0.005 | 0.007 | 0.004 | 0.005 | 0.016 | 0.011 | 0.018 | 0.017 |
| Pb | 0.003 | 0.003 | 0.006 | 0.008 | 0.004 | 0.006 | 0.006 | 0.006 | 0.004 | 0.005 | 0.003 | 0.003 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.002 | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.002 | | | | 0.000 | 0.001 | 0.002 | | | | |
| Bi | | | | | | | | | | | | | | |
| Sc | 0.004 | 0.005 | 0.009 | 0.011 | | | | 0.000 | 0.000 | 0.000 | | | | |
| Ca | 0.006 | 0.006 | 0.007 | 0.006 | 0.002 | 0.003 | 0.004 | 0.000 | 0.003 | 0.003 | 0.004 | 0.006 | 0.008 | 0.010 |
| Total | 3.027 | 3.011 | 3.009 | 3.012 | 2.967 | 3.038 | 3.028 | 2.982 | 3.023 | 3.022 | 3.038 | 3.054 | 3.051 | 3.034 |
| Mn/(Mn+Fe) | 0.402 | 0.351 | 0.362 | 0.343 | 0.396 | 0.323 | 0.347 | 0.310 | 0.343 | 0.345 | 0.336 | 0.345 | 0.354 | 0.319 |
| Ta/(Ta+Nb) | 0.628 | 0.597 | 0.446 | 0.364 | 0.222 | 0.222 | 0.212 | 0.279 | 0.272 | 0.275 | 0.572 | 0.611 | 0.569 | 0.591 |
| Comments: | PG & PI<br>same grain | | PK & PL<br>same grain | | associated, but not in contact with large euhedral cassiterite | MD & ME<br>same grain | | | | | isolated grains<br>closely assoc.<br>with cassiterite | | isolated grains<br>closely assoc.<br>with cassiterite | |

| | | | East Beryl pegmatite | | | | | | | | East Beryl pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94-1a(a) | | | | | | | | 94-1a(b) | | | | | |
| | DA | DJ | DK | DL | DM | DN | DR | ZE | ZF | ZG | ZH | ZI | ZJ | ZK | ZL | ZM |
| FeO | 14.22 | 15.32 | 15.28 | 15.53 | 15.50 | 15.53 | 15.55 | 15.03 | 14.56 | 14.36 | 14.46 | 13.12 | 13.39 | 13.76 | 15.32 | 15.13 |
| MnO | 5.91 | 4.96 | 4.95 | 4.92 | 4.46 | 4.68 | 3.80 | 4.39 | 4.50 | 4.79 | 4.71 | 6.18 | 6.01 | 5.34 | 4.74 | 4.64 |
| TiO2 | 0.61 | 0.62 | 1.02 | 0.91 | 1.21 | 1.24 | 1.06 | 0.58 | 0.55 | 0.56 | 0.72 | 0.59 | 0.61 | 0.60 | 0.48 | 0.59 |
| Nb2O5 | 62.86 | 65.88 | 65.81 | 66.40 | 63.99 | 63.03 | 54.12 | 61.40 | 57.57 | 58.56 | 59.29 | 59.44 | 60.06 | 55.71 | 66.45 | 63.01 |
| Ta2O5 | 16.03 | 12.94 | 11.81 | 11.63 | 13.73 | 12.59 | 24.31 | 17.57 | 22.21 | 20.83 | 19.60 | 19.66 | 19.39 | 23.90 | 12.10 | 14.37 |
| SnO2 | 0.24 | 0.27 | 0.02 | 0.00 | 0.07 | 0.22 | 0.00 | 0.08 | 0.08 | 0.12 | 0.23 | 0.12 | 0.13 | 0.10 | 0.05 | 0.06 |
| WO3 | 0.57 | 0.63 | 0.87 | 0.78 | 0.86 | 0.57 | 0.86 | 0.58 | 0.48 | 0.36 | 0.37 | 0.55 | 0.55 | 0.48 | 0.42 | 0.67 |
| PbO | 0.40 | 0.27 | 0.00 | 0.41 | 0.62 | 0.44 | 0.61 | 0.27 | 0.32 | 0.30 | 0.33 | 0.33 | 0.29 | 0.28 | 0.27 | 0.31 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.12 | 0.00 | 0.03 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.38 | 0.00 | 0.00 | 0.27 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.40 | 0.01 | 0.58 | 0.00 | 0.03 | 0.31 | 0.49 | 0.11 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.00 |
| CaO | | | | | | | | | | | | | | | | |
| Total | 101.62 | 100.92 | 100.37 | 100.84 | 100.51 | 98.87 | 100.81 | 100.03 | 100.40 | 99.88 | 99.74 | 100.00 | 100.43 | 100.21 | 99.88 | 98.78 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.705 | 0.754 | 0.749 | 0.762 | 0.769 | 0.781 | 0.804 | 0.760 | 0.748 | 0.737 | 0.740 | 0.670 | 0.680 | 0.714 | 0.758 | 0.766 |
| Mn | 0.297 | 0.247 | 0.246 | 0.244 | 0.224 | 0.238 | 0.199 | 0.225 | 0.234 | 0.249 | 0.244 | 0.320 | 0.309 | 0.281 | 0.237 | 0.238 |
| Ti | 0.027 | 0.027 | 0.045 | 0.040 | 0.054 | 0.056 | 0.049 | 0.026 | 0.026 | 0.026 | 0.033 | 0.027 | 0.028 | 0.028 | 0.021 | 0.027 |
| Nb | 1.685 | 1.752 | 1.744 | 1.761 | 1.716 | 1.712 | 1.514 | 1.678 | 1.599 | 1.626 | 1.640 | 1.641 | 1.648 | 1.562 | 1.778 | 1.725 |
| Ta | 0.259 | 0.207 | 0.188 | 0.185 | 0.221 | 0.206 | 0.409 | 0.289 | 0.371 | 0.348 | 0.326 | 0.326 | 0.320 | 0.403 | 0.195 | 0.237 |
| Sn | 0.006 | 0.006 | 0.001 | 0.000 | 0.002 | 0.005 | 0.000 | 0.002 | 0.002 | 0.003 | 0.006 | 0.003 | 0.003 | 0.002 | 0.001 | 0.001 |
| W | 0.009 | 0.010 | 0.013 | 0.012 | 0.013 | 0.009 | 0.014 | 0.009 | 0.008 | 0.006 | 0.006 | 0.009 | 0.009 | 0.008 | 0.006 | 0.010 |
| Pb | 0.006 | 0.004 | 0.000 | 0.006 | 0.010 | 0.007 | 0.010 | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.006 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.021 | 0.000 | 0.029 | 0.000 | 0.002 | 0.016 | 0.026 | 0.006 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.020 | 3.008 | 3.015 | 3.015 | 3.011 | 3.033 | 3.026 | 3.000 | 2.999 | 3.000 | 3.000 | 3.002 | 3.000 | 3.005 | 3.004 | 3.009 |
| Mn/(Mn+Fe) | 0.296 | 0.247 | 0.247 | 0.243 | 0.226 | 0.234 | 0.199 | 0.228 | 0.238 | 0.253 | 0.248 | 0.323 | 0.312 | 0.282 | 0.238 | 0.237 |
| Ta/(Ta+Nb) | 0.133 | 0.106 | 0.097 | 0.095 | 0.114 | 0.107 | 0.213 | 0.147 | 0.188 | 0.176 | 0.166 | 0.166 | 0.163 | 0.205 | 0.099 | 0.121 |
| Comments: | cluster of grains associated with monazite | | | | | | rim of oscillatory zoned grain | ZE - ZM traverse along single crystal | | | ZE, ZL & ZM are from recrystallized ends | | | | | |

## Columbite-Tantalite Group

| | East Beryl pegmatite | | | | E Beryl | East Beryl pegmatite | | | | | East Beryl pegmatite | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-1a(c) | | | | 94-1a(d) | 94-1b | | | | | 94-2 | | | | | | |
| | YA | YB | YC | YF | AG | AA | AB | AC | AD | AE | KA | KB | KC | KE | KF | KG | KH |
| FeO | 14.99 | 16.60 | 16.05 | 15.09 | 14.56 | 13.44 | 13.76 | 14.22 | 13.81 | 11.07 | 13.91 | 14.45 | 15.45 | 16.06 | 15.95 | 16.26 | 13.98 |
| MnO | 3.93 | 3.64 | 3.42 | 4.03 | 5.15 | 5.26 | 5.43 | 5.04 | 5.40 | 7.87 | 5.58 | 4.79 | 4.01 | 3.47 | 3.33 | 3.33 | 4.58 |
| TiO2 | 0.61 | 0.63 | 0.73 | 0.61 | 0.62 | 0.52 | 0.53 | 0.53 | 0.56 | 0.71 | 0.96 | 1.27 | 1.20 | 1.69 | 1.97 | 1.90 | 1.29 |
| Nb2O5 | 57.16 | 64.95 | 59.70 | 58.04 | 63.38 | 52.48 | 58.18 | 58.81 | 58.63 | 56.57 | 50.92 | 51.17 | 49.20 | 50.28 | 49.59 | 50.72 | 46.08 |
| Ta2O5 | 21.42 | 12.76 | 18.71 | 20.67 | 14.26 | 26.90 | 20.81 | 20.31 | 20.36 | 21.57 | 27.89 | 27.47 | 28.67 | 28.08 | 27.75 | 27.36 | 32.33 |
| SnO2 | 0.12 | 0.05 | 0.15 | 0.14 | 0.22 | 0.12 | 0.08 | 0.10 | 0.10 | 0.19 | 0.17 | 0.24 | 0.24 | 0.33 | 0.35 | 0.32 | 0.27 |
| WO3 | 0.32 | 0.70 | 0.49 | 0.26 | 0.52 | 0.42 | 0.40 | 0.39 | 0.40 | 0.49 | 0.44 | 0.40 | 0.15 | 0.30 | 0.28 | 0.24 | 0.10 |
| PbO | 0.26 | 0.35 | 0.29 | 0.29 | 0.37 | 0.22 | 0.33 | 0.29 | 0.27 | 0.28 | 0.25 | 0.22 | 0.24 | 0.25 | 0.19 | 0.27 | 0.26 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.04 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.05 | 0.02 | 0.03 | 0.03 | 0.32 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.05 | 0.02 | 0.08 | 0.05 | 0.05 | 0.06 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | |
| Sc2O3 | 0.01 | 0.12 | 0.02 | 0.00 | 0.44 | 0.00 | 0.11 | 0.10 | 0.04 | 0.15 | 0.15 | 0.35 | 0.29 | 0.15 | 0.14 | 0.17 | 0.41 |
| CaO | | | | | 0.00 | | | | | | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.10 |
| Total | 98.81 | 99.78 | 99.56 | 99.12 | 99.95 | 99.35 | 99.62 | 99.79 | 99.57 | 98.89 | 100.37 | 100.48 | 99.55 | 100.75 | 99.70 | 100.69 | 99.82 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | |
| Fe | 0.781 | 0.826 | 0.820 | 0.781 | 0.729 | 0.713 | 0.709 | 0.730 | 0.710 | 0.576 | 0.734 | 0.758 | 0.824 | 0.842 | 0.844 | 0.850 | 0.756 |
| Mn | 0.207 | 0.183 | 0.177 | 0.211 | 0.261 | 0.283 | 0.283 | 0.262 | 0.281 | 0.415 | 0.298 | 0.254 | 0.217 | 0.184 | 0.178 | 0.176 | 0.251 |
| Ti | 0.028 | 0.028 | 0.034 | 0.028 | 0.028 | 0.025 | 0.024 | 0.024 | 0.026 | 0.033 | 0.046 | 0.060 | 0.058 | 0.080 | 0.094 | 0.089 | 0.063 |
| Nb | 1.609 | 1.748 | 1.649 | 1.623 | 1.715 | 1.506 | 1.620 | 1.631 | 1.630 | 1.592 | 1.452 | 1.451 | 1.419 | 1.425 | 1.418 | 1.433 | 1.347 |
| Ta | 0.363 | 0.207 | 0.311 | 0.348 | 0.232 | 0.464 | 0.349 | 0.339 | 0.340 | 0.365 | 0.478 | 0.469 | 0.497 | 0.479 | 0.477 | 0.465 | 0.569 |
| Sn | 0.003 | 0.001 | 0.004 | 0.003 | 0.005 | 0.003 | 0.002 | 0.002 | 0.003 | 0.005 | 0.004 | 0.006 | 0.006 | 0.008 | 0.009 | 0.008 | 0.007 |
| W | 0.005 | 0.011 | 0.008 | 0.004 | 0.008 | 0.007 | 0.006 | 0.006 | 0.006 | 0.008 | 0.007 | 0.007 | 0.002 | 0.005 | 0.005 | 0.004 | 0.002 |
| Pb | 0.004 | 0.006 | 0.005 | 0.005 | 0.006 | 0.004 | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.003 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.005 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.006 | 0.001 | 0.000 | 0.023 | 0.000 | 0.006 | 0.005 | 0.002 | 0.008 | 0.008 | 0.019 | 0.016 | 0.008 | 0.008 | 0.009 | 0.023 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.007 |
| Total | 3.001 | 3.015 | 3.007 | 3.003 | 3.013 | 3.004 | 3.005 | 3.004 | 3.003 | 3.007 | 3.035 | 3.031 | 3.047 | 3.040 | 3.040 | 3.043 | 3.036 |
| Mn/(Mn+Fe) | 0.210 | 0.182 | 0.177 | 0.213 | 0.264 | 0.284 | 0.286 | 0.264 | 0.284 | 0.419 | 0.289 | 0.251 | 0.208 | 0.180 | 0.175 | 0.172 | 0.249 |
| Ta/(Ta+Nb) | 0.184 | 0.106 | 0.159 | 0.176 | 0.119 | 0.236 | 0.177 | 0.172 | 0.173 | 0.187 | 0.248 | 0.244 | 0.260 | 0.251 | 0.252 | 0.245 | 0.297 |
| Comments: | YB & YC<br>same inclusion in garnet | | | | | strongly zoned in parts such as at AA | | | | | all data from single unzoned grain | | | | | | |

| | SW Beryl pegmatite | | | | East Beryl pegmatite | | | | East Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-15A | | | | 94-24 | | | | 94-24A | | | | |
| | FG | CG | CH | CI | GF | GG | GI | GJ | ZH | ZJ | ZF | ZG | ZJ |
| FeO | 13.37 | 14.29 | 15.44 | 15.01 | 14.04 | 14.51 | 12.10 | 12.68 | 13.15 | 13.22 | 13.14 | 14.17 | 13.72 |
| MnO | 4.70 | 4.05 | 4.49 | 4.39 | 8.16 | 7.79 | 9.21 | 8.92 | 6.90 | 7.13 | 7.28 | 6.91 | 7.43 |
| TiO2 | 0.54 | 0.80 | 0.71 | 0.79 | 1.15 | 1.35 | 0.81 | 1.02 | 1.21 | 1.15 | 1.21 | 0.99 | 1.39 |
| Nb2O5 | 41.48 | 47.79 | 65.82 | 59.95 | 69.88 | 67.81 | 67.27 | 66.47 | 63.96 | 67.43 | 70.61 | 66.62 | 68.37 |
| Ta2O5 | 37.66 | 30.35 | 11.76 | 18.28 | 6.65 | 7.24 | 10.04 | 10.33 | 11.23 | 7.44 | 7.39 | 10.65 | 8.01 |
| SnO2 | 0.24 | 0.41 | 0.19 | 0.30 | 0.00 | 0.03 | 0.00 | 0.02 | 0.03 | 0.02 | 0.02 | 0.00 | 0.00 |
| WO3 | 0.16 | 0.48 | 0.35 | 0.29 | 0.62 | 0.64 | 0.46 | 0.75 | 0.51 | 0.55 | 0.63 | 0.55 | 0.82 |
| PbO | 0.50 | 0.41 | 0.59 | 0.52 | 0.28 | 0.34 | 0.28 | 0.28 | 0.30 | 0.32 | 0.29 | 0.29 | 0.38 |
| ThO2 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 |
| UO2 | 0.16 | 0.00 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.05 | 0.03 | 0.05 | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | |
| Sc2O3 | 0.07 | 0.08 | 0.05 | 0.07 | | | | | | | | | |
| CaO | 0.14 | 0.04 | 0.04 | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 |
| Total | 99.02 | 98.85 | 99.52 | 99.74 | 100.82 | 99.76 | 100.22 | 100.51 | 99.99 | 100.09 | 100.62 | 100.23 | 100.17 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.752 | 0.777 | 0.768 | [illegible] | 0.674 | 0.707 | 0.592 | 0.620 | 0.646 | 0.639 | 0.631 | 0.695 | 0.666 |
| Mn | 0.268 | 0.223 | 0.226 | [illegible] | 0.397 | 0.384 | 0.457 | 0.442 | 0.343 | 0.349 | 0.354 | 0.343 | 0.365 |
| Ti | 0.027 | 0.039 | 0.032 | 0.036 | 0.050 | 0.059 | 0.036 | 0.045 | 0.053 | 0.050 | 0.052 | 0.044 | 0.061 |
| Nb | 1.261 | 1.405 | 1.769 | 1.652 | 1.814 | 1.786 | 1.781 | 1.758 | 1.767 | 1.833 | 1.834 | 1.767 | 1.794 |
| Ta | 0.689 | 0.537 | 0.190 | 0.303 | 0.104 | 0.115 | 0.160 | 0.164 | 0.181 | 0.118 | 0.115 | 0.170 | 0.126 |
| Sn | 0.006 | 0.011 | 0.005 | 0.007 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| W | 0.003 | 0.008 | 0.005 | 0.005 | 0.009 | 0.010 | 0.007 | 0.011 | 0.008 | 0.008 | 0.009 | 0.008 | 0.012 |
| Pb | 0.009 | 0.007 | 0.009 | 0.009 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.005 | 0.006 |
| Th | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.001 | 0.001 | | | | | | | | | |
| Bi | | | | | | | | | | | | | |
| Sc | 0.004 | 0.005 | 0.003 | 0.004 | | | | | | | | | |
| Ca | 0.010 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 |
| Total | 3.032 | 3.017 | 3.011 | 3.012 | 3.055 | 3.069 | 3.039 | 3.048 | 3.007 | 3.006 | 3.004 | 3.035 | 3.033 |
| Mn/(Mn+Fe) | 0.263 | 0.223 | 0.228 | 0.229 | 0.371 | 0.352 | 0.435 | 0.416 | 0.347 | 0.353 | 0.359 | 0.331 | 0.354 |
| Ta/(Ta+Nb) | 0.353 | 0.276 | 0.097 | 0.155 | 0.054 | 0.060 | 0.082 | 0.085 | 0.093 | 0.061 | 0.059 | 0.088 | 0.066 |
| Comments: | | incl. in | | | F, G, I and J same grain | | | | | | | | |
| | | cassiterite | | | core = J | | | | | | | | |

| | **Separation Rapids pluton** | | | | | **Separation Rapids pluton** | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-29 | | | | | 94-29A | | | | | | | | | | |
| | XA | XB | XC | XD | XE | #1 | #2 | #3 | #4 | #5 | BA | BB | BC | BD | BF | BG |
| FeO | 14.16 | 11.89 | 11.24 | 11.87 | 12.09 | 13.83 | 15.17 | 14.44 | 12.74 | 14.10 | 14.29 | 14.17 | 13.58 | 14.08 | 13.78 | 13.97 |
| MnO | 4.80 | 5.84 | 5.98 | 5.68 | 5.66 | 3.65 | 4.19 | 4.02 | 5.43 | 5.54 | 5.14 | 5.09 | 4.81 | 5.56 | 5.89 | 5.31 |
| TiO2 | 0.38 | 0.40 | 0.42 | 0.52 | 0.45 | 0.39 | 0.55 | 0.31 | 0.40 | 0.46 | 0.51 | 0.42 | 0.50 | 0.46 | 0.42 | 0.51 |
| Nb2O5 | 60.13 | 46.47 | 39.88 | 45.38 | 46.93 | 48.58 | 60.51 | 55.22 | 47.89 | 62.61 | 54.90 | 55.36 | 44.23 | 59.20 | 58.22 | 58.22 |
| Ta2O5 | 19.88 | 34.67 | 41.11 | 35.57 | 33.44 | 31.72 | 18.69 | 24.34 | 31.68 | 16.01 | 23.69 | 23.95 | 36.59 | 19.31 | 20.25 | 19.58 |
| SnO2 | 0.03 | 0.05 | 0.05 | 0.07 | 0.07 | 0.01 | 0.04 | 0.03 | 0.05 | 0.06 | 0.34 | 0.07 | 0.10 | 0.02 | 0.00 | 0.08 |
| WO3 | 0.53 | 0.43 | 0.43 | 0.47 | 0.47 | 0.47 | 0.51 | 0.41 | 0.47 | 0.46 | 0.49 | 0.46 | 0.50 | 0.68 | 0.32 | 0.44 |
| PbO | 0.26 | 0.20 | 0.21 | 0.19 | 0.20 | 0.22 | 0.31 | 0.26 | 0.26 | 0.31 | 0.41 | 0.13 | 0.25 | 0.20 | 0.49 | 0.55 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.02 | 0.11 | 0.00 | 0.04 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.46 |
| Sc2O3 | 0.00 | 0.00 | 0.03 | 0.06 | 0.05 | 0.11 | 0.16 | 0.11 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.40 | 0.10 |
| CaO | | | | | | | | | | | | | | | | |
| Total | 100.17 | 99.95 | 99.35 | 99.80 | 99.36 | 98.98 | 100.13 | 99.12 | 98.91 | 99.55 | 100.12 | 99.65 | 100.57 | 99.62 | 100.01 | 99.25 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.721 | 0.648 | 0.637 | 0.651 | 0.660 | 0.752 | 0.770 | 0.759 | 0.695 | 0.712 | 0.745 | 0.740 | 0.744 | 0.722 | 0.707 | 0.723 |
| Mn | 0.248 | 0.323 | 0.343 | 0.316 | 0.313 | 0.201 | 0.215 | 0.214 | 0.300 | 0.283 | 0.271 | 0.269 | 0.267 | 0.289 | 0.306 | 0.278 |
| Ti | 0.017 | 0.020 | 0.022 | 0.026 | 0.022 | 0.019 | 0.025 | 0.015 | 0.020 | 0.021 | 0.024 | 0.020 | 0.024 | 0.021 | 0.020 | 0.024 |
| Nb | 1.656 | 1.370 | 1.221 | 1.345 | 1.385 | 1.428 | 1.660 | 1.569 | 1.412 | 1.710 | 1.547 | 1.563 | 1.310 | 1.641 | 1.616 | 1.629 |
| Ta | 0.329 | 0.615 | 0.757 | 0.634 | 0.594 | 0.561 | 0.308 | 0.416 | 0.562 | 0.263 | 0.402 | 0.407 | 0.652 | 0.322 | 0.338 | 0.330 |
| Sn | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.009 | 0.002 | 0.003 | 0.000 | 0.000 | 0.002 |
| W | 0.008 | 0.007 | 0.008 | 0.008 | 0.008 | 0.008 | 0.008 | 0.007 | 0.008 | 0.007 | 0.008 | 0.007 | 0.008 | 0.011 | 0.005 | 0.007 |
| Pb | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.007 | 0.002 | 0.004 | 0.003 | 0.008 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 |
| Sc | 0.000 | 0.000 | 0.002 | 0.003 | 0.003 | 0.006 | 0.008 | 0.006 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.021 | 0.005 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.986 | 2.987 | 2.994 | 2.987 | 2.990 | 2.979 | 3.001 | 2.991 | 3.002 | 3.003 | 3.023 | 3.009 | 3.013 | 3.011 | 3.025 | 3.015 |
| Mn/(Mn+Fe) | 0.256 | 0.332 | 0.350 | 0.327 | 0.322 | 0.211 | 0.219 | 0.220 | 0.301 | 0.284 | 0.267 | 0.267 | 0.264 | 0.286 | 0.302 | 0.278 |
| Ta/(Ta+Nb) | 0.166 | 0.310 | 0.383 | 0.320 | 0.300 | 0.282 | 0.157 | 0.210 | 0.285 | 0.133 | 0.206 | 0.207 | 0.332 | 0.164 | 0.173 | 0.168 |
| Comments: | XA - XE same grain<br>unzoned apart from<br>patchy zonation at one end | | | | | | | | | | BA - BC<br>same grain | | | | | |

**Separation Rapids pluton**

94-29A

| | BM | BN | BV | BW | BR | BS | BU | AA | AB | AE | AF | AG | AH | AI | AJ | AK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.50 | 14.71 | 10.95 | 11.80 | 13.91 | 14.25 | 13.61 | 15.67 | 15.59 | 15.78 | 15.55 | 15.47 | 14.24 | 14.84 | 15.81 | 15.19 |
| MnO | 6.51 | 5.50 | 5.02 | 5.79 | 5.45 | 5.21 | 4.85 | 4.46 | 4.34 | 4.36 | 4.39 | 4.23 | 4.05 | 4.04 | 4.17 | 4.15 |
| TiO2 | 0.51 | 0.58 | 0.23 | 0.32 | 0.39 | 0.44 | 0.37 | 0.76 | 0.88 | 0.49 | 0.50 | 0.39 | 0.34 | 0.32 | 0.53 | 0.39 |
| Nb2O5 | 63.20 | 64.07 | 24.83 | 32.05 | 53.11 | 53.95 | 42.29 | 67.89 | 67.30 | 65.08 | 64.11 | 61.06 | 47.45 | 53.37 | 64.90 | 56.99 |
| Ta2O5 | 14.45 | 12.99 | 56.66 | 50.48 | 26.99 | 25.93 | 38.93 | 9.28 | 9.30 | 13.04 | 14.19 | 18.19 | 32.99 | 26.05 | 12.88 | 21.69 |
| SnO2 | 0.00 | 0.00 | 0.03 | 0.14 | 0.14 | 0.00 | 0.15 | 0.05 | 0.08 | 0.03 | 0.02 | 0.04 | 0.07 | 0.04 | 0.04 | 0.05 |
| WO3 | 0.47 | 0.62 | 0.00 | 0.08 | 0.54 | 0.21 | 0.32 | 0.67 | 1.02 | 0.65 | 0.10 | 0.24 | 0.17 | 0.44 | 0.52 | 0.53 |
| PbO | 0.11 | 0.43 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.42 | 0.35 | 0.30 | 0.42 | 0.39 | 0.24 | 0.25 | 0.41 | 0.42 |
| ThO2 | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.36 | 0.22 | 0.00 | 0.20 | 0.06 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.09 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 |
| Bi2O3 | 0.03 | 0.37 | 0.00 | 0.23 | 0.28 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.23 | 0.00 | 0.25 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.22 | 0.00 | 0.13 | 0.09 | 0.00 | 0.06 | 0.00 | 0.17 |
| CaO | | | | | | | | | | | | | | | | |
| Total | 99.37 | 99.48 | 98.20 | 101.08 | 100.86 | 100.21 | 100.51 | 99.19 | 99.08 | 99.73 | 99.39 | 100.09 | 99.55 | 99.43 | 99.26 | 99.57 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.679 | 0.739 | 0.680 | 0.688 | 0.728 | 0.746 | 0.753 | 0.773 | 0.769 | 0.787 | 0.780 | 0.785 | 0.775 | 0.785 | 0.792 | 0.788 |
| Mn | 0.332 | 0.280 | 0.315 | 0.342 | 0.289 | 0.276 | 0.272 | 0.223 | 0.217 | 0.220 | 0.223 | 0.217 | 0.224 | 0.217 | 0.211 | 0.218 |
| Ti | 0.023 | 0.026 | 0.013 | 0.017 | 0.018 | 0.021 | 0.018 | 0.033 | 0.039 | 0.022 | 0.022 | 0.018 | 0.016 | 0.015 | 0.024 | 0.018 |
| Nb | 1.720 | 1.740 | 0.833 | 1.009 | 1.503 | 1.527 | 1.265 | 1.810 | 1.796 | 1.754 | 1.740 | 1.674 | 1.397 | 1.526 | 1.757 | 1.598 |
| Ta | 0.236 | 0.212 | 1.144 | 0.956 | 0.459 | 0.441 | 0.701 | 0.149 | 0.149 | 0.211 | 0.232 | 0.300 | 0.584 | 0.448 | 0.210 | 0.366 |
| Sn | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.000 | 0.004 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 |
| W | 0.007 | 0.010 | 0.000 | 0.001 | 0.009 | 0.003 | 0.005 | 0.010 | 0.016 | 0.010 | 0.002 | 0.004 | 0.003 | 0.007 | 0.008 | 0.009 |
| Pb | 0.002 | 0.007 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.007 | 0.006 | 0.005 | 0.007 | 0.006 | 0.004 | 0.004 | 0.007 | 0.007 |
| Th | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.005 | 0.003 | 0.000 | 0.003 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.006 | 0.000 | 0.004 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.012 | 0.000 | 0.016 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 | 0.007 | 0.005 | 0.000 | 0.003 | 0.000 | 0.009 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.017 | 3.021 | 3.008 | 3.023 | 3.015 | 3.018 | 3.019 | 3.006 | 3.005 | 3.009 | 3.013 | 3.010 | 3.005 | 3.007 | 3.009 | 3.014 |
| Mn/(Mn+Fe) | 0.328 | 0.275 | 0.317 | 0.332 | 0.284 | 0.270 | 0.265 | 0.224 | 0.220 | 0.219 | 0.222 | 0.217 | 0.224 | 0.216 | 0.211 | 0.217 |
| Ta/(Ta+Nb) | 0.121 | 0.109 | 0.579 | 0.487 | 0.234 | 0.224 | 0.356 | 0.076 | 0.077 | 0.108 | 0.117 | 0.152 | 0.295 | 0.227 | 0.107 | 0.186 |
| Comments: | BM & BN | | BV, BW, BR & BS same grain | | | | | AA & AB same grain | | | | | AF, AG & AH | | AJ & AK same grain | |
| | same grain | | core | inter. | rim | rim | secondary | | | complex zoning | | | same grain | | patchy zoned | |

## Columbite-Tantalite Group

|  | Pegmatite 1 |  |  |  |  | Pegmatite 1 |  |  |  |  | Marko's pegmatite |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-34 |  |  |  |  | 94-34C |  |  |  |  | 94-44A |  |  |  |  |
|  | LC | LD | LI | CD | CE | GJ | GM | GN | GQ | GR | VB | VQ | VR | VT | VX |
| FeO | 11.20 | 10.93 | 12.49 | 13.06 | 13.15 | 11.89 | 11.78 | 12.14 | 12.67 | 11.94 | 1.95 | 2.27 | 2.26 | 2.26 | 2.18 |
| MnO | 5.66 | 5.80 | 5.86 | 6.42 | 6.89 | 6.36 | 6.48 | 6.55 | 6.49 | 6.50 | 14.36 | 13.06 | 13.29 | 13.32 | 13.68 |
| TiO2 | 0.44 | 0.55 | 0.43 | 0.51 | 0.61 | 0.40 | 0.45 | 0.40 | 0.43 | 0.43 | 1.61 | 1.27 | 1.29 | 1.25 | 1.10 |
| Nb2O5 | 37.85 | 33.85 | 52.71 | 56.33 | 57.91 | 55.02 | 54.27 | 55.04 | 52.60 | 52.62 | 24.23 | 17.37 | 18.08 | 18.31 | 19.41 |
| Ta2O5 | 42.80 | 47.25 | 26.84 | 23.00 | 20.05 | 25.60 | 25.64 | 25.03 | 26.57 | 26.56 | 54.36 | 61.41 | 62.53 | 62.28 | 60.47 |
| SnO2 | 0.20 | 0.33 | 0.16 | 0.05 | 0.07 | 0.11 | 0.17 | 0.13 | 0.13 | 0.13 | 0.40 | 2.27 | 0.49 | 0.50 | 1.31 |
| WO3 | 0.11 | 0.12 | 0.22 | 0.50 | 0.64 | 0.21 | 0.44 | 0.27 | 0.35 | 0.35 | 0.49 | 0.25 | 0.23 | 0.18 | 0.22 |
| PbO | 0.41 | 0.40 | 0.58 | 0.29 | 0.34 | 0.21 | 0.28 | 0.22 | 0.24 | 0.24 | 0.08 | 0.13 | 0.07 | 0.18 | 0.10 |
| ThO2 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 |
| UO2 | 0.24 | 0.10 | 0.13 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 0.06 | 0.00 |
| Sb2O3 | 0.06 | 0.08 | 0.06 | 0.00 | 0.00 | 0.05 | 0.03 | 0.03 | 0.05 | 0.05 |  |  |  |  |  |
| Bi2O3 |  |  |  | 0.00 | 0.00 |  |  |  |  |  |  |  |  |  |  |
| Sc2O3 | 0.03 | 0.07 | 0.02 | 0.11 | 0.05 | 0.02 | 0.02 | 0.00 | 0.02 | 0.02 |  |  |  |  |  |
| CaO | 0.14 | 0.14 | 0.14 | 0.02 | 0.00 | 0.03 | 0.06 | 0.03 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.15 | 99.65 | 99.64 | 100.26 | 99.70 | 99.91 | 99.68 | 99.87 | 99.59 | 98.88 | 98.99 | 99.46 | 99.60 | 99.71 | 99.85 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.643 | 0.637 | 0.662 | 0.675 | 0.677 | 0.622 | 0.619 | 0.635 | 0.671 | 0.636 | 0.118 | 0.143 | 0.142 | 0.142 | 0.136 |
| Mn | 0.329 | 0.342 | 0.315 | 0.336 | 0.359 | 0.337 | 0.345 | 0.347 | 0.348 | 0.351 | 0.882 | 0.834 | 0.846 | 0.847 | 0.862 |
| Ti | 0.023 | 0.029 | 0.021 | 0.024 | 0.028 | 0.019 | 0.021 | 0.019 | 0.020 | 0.021 | 0.088 | 0.072 | 0.073 | 0.071 | 0.062 |
| Nb | 1.175 | 1.067 | 1.511 | 1.574 | 1.610 | 1.556 | 1.542 | 1.556 | 1.505 | 1.515 | 0.826 | 0.616 | 0.639 | 0.646 | 0.679 |
| Ta | 0.799 | 0.896 | 0.463 | 0.387 | 0.335 | 0.435 | 0.438 | 0.426 | 0.457 | 0.460 | 1.083 | 1.272 | 1.290 | 1.284 | 1.236 |
| Sn | 0.005 | 0.009 | 0.004 | 0.001 | 0.002 | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 | 0.012 | 0.068 | 0.015 | 0.015 | 0.039 |
| W | 0.002 | 0.002 | 0.004 | 0.008 | 0.010 | 0.003 | 0.007 | 0.004 | 0.006 | 0.006 | 0.009 | 0.005 | 0.004 | 0.004 | 0.004 |
| Pb | 0.008 | 0.008 | 0.010 | 0.005 | 0.006 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.002 | 0.003 | 0.001 | 0.004 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.004 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |  |  |  |  |  |
| Bi |  |  |  | 0.000 | 0.000 |  |  |  |  |  |  |  |  |  |  |
| Sc | 0.002 | 0.004 | 0.001 | 0.006 | 0.003 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |  |  |  |  |  |
| Ca | 0.010 | 0.010 | 0.010 | 0.001 | 0.000 | 0.002 | 0.004 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.001 | 3.009 | 3.004 | 3.016 | 3.030 | 2.983 | 2.988 | 2.996 | 3.019 | 3.000 | 3.019 | 3.016 | 3.010 | 3.012 | 3.019 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mn/(Mn+Fe) | 0.339 | 0.350 | 0.322 | 0.333 | 0.347 | 0.351 | 0.358 | 0.353 | 0.342 | 0.355 | 0.882 | 0.854 | 0.856 | 0.857 | 0.864 |
| Ta/(Ta+Nb) | 0.405 | 0.456 | 0.234 | 0.197 | 0.172 | 0.219 | 0.221 | 0.215 | 0.233 | 0.233 | 0.567 | 0.674 | 0.669 | 0.665 | 0.645 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: |  |  |  | CD & CE<br>same grain |  |  |  | isolated grains |  |  |  |  | all from single grain intergrown<br>with wodginite and microlite |  |  |

| | Marko's pegmatite | | | | Marko's pegmatite | | | Marko's pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44C | | | | 94-44D | | | 94-44E1 | | |
| | YC | YG | YH | YL | BB | BC | BE | KE | KF | KJ |
| FeO | 2.38 | 2.22 | 2.17 | 2.24 | 2.09 | 2.34 | 2.30 | 2.16 | 2.06 | 3.21 |
| MnO | 14.49 | 14.50 | 15.02 | 14.53 | 14.60 | 14.24 | 14.19 | 14.84 | 14.52 | 14.93 |
| TiO2 | 1.83 | 0.84 | 0.87 | 0.74 | 1.03 | 1.14 | 0.79 | 0.88 | 1.00 | 2.59 |
| Nb2O5 | 32.68 | 31.54 | 31.81 | 31.88 | 32.60 | 32.90 | 30.30 | 24.77 | 27.26 | 54.91 |
| Ta2O5 | 46.74 | 51.32 | 50.21 | 49.75 | 47.95 | 47.63 | 50.78 | 57.44 | 54.63 | 23.18 |
| SnO2 | 0.50 | 0.15 | 0.17 | 0.22 | 0.28 | 0.31 | 0.19 | 0.12 | 0.15 | 0.25 |
| WO3 | 0.34 | 0.15 | 0.27 | 0.15 | 0.54 | 0.74 | 0.77 | 0.30 | 0.31 | 0.73 |
| PbO | 0.25 | 0.16 | 0.18 | 0.16 | 0.19 | 0.16 | 0.16 | 0.11 | 0.10 | 0.35 |
| ThO2 | 0.00 | 0.02 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 |
| Sb2O3 | | | | | 0.00 | 0.00 | 0.00 | | | |
| Bi2O3 | | | | | 0.00 | 0.00 | 0.00 | | | |
| Sc2O3 | | | | | 0.06 | 0.00 | 0.00 | | | |
| CaO | 0.05 | 0.07 | 0.05 | 0.11 | 0.03 | 0.05 | 0.03 | 0.07 | 0.18 | 0.52 |
| Total | 99.26 | 100.97 | 100.75 | 99.84 | 99.38 | 99.52 | 99.52 | 100.68 | 100.23 | 100.76 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | |
| Fe | 0.138 | 0.129 | 0.126 | 0.131 | 0.122 | 0.136 | 0.136 | 0.130 | 0.123 | 0.164 |
| Mn | 0.851 | 0.854 | 0.884 | 0.862 | 0.864 | 0.839 | 0.851 | 0.906 | 0.878 | 0.770 |
| Ti | 0.095 | 0.044 | 0.045 | 0.039 | 0.054 | 0.060 | 0.042 | 0.048 | 0.054 | 0.119 |
| Nb | 1.025 | 0.991 | 0.999 | 1.010 | 1.029 | 1.035 | 0.970 | 0.808 | 0.880 | 1.512 |
| Ta | 0.882 | 0.970 | 0.948 | 0.948 | 0.911 | 0.901 | 0.978 | 1.127 | 1.060 | 0.384 |
| Sn | 0.014 | 0.004 | 0.005 | 0.006 | 0.008 | 0.009 | 0.005 | 0.003 | 0.004 | 0.006 |
| W | 0.006 | 0.003 | 0.005 | 0.003 | 0.010 | 0.013 | 0.014 | 0.006 | 0.006 | 0.011 |
| Pb | 0.005 | 0.003 | 0.003 | 0.003 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.006 |
| Th | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sb | | | | | 0.000 | 0.000 | 0.000 | | | |
| Bi | | | | | 0.000 | 0.000 | 0.000 | | | |
| Sc | | | | | 0.004 | 0.000 | 0.000 | | | |
| Ca | 0.004 | 0.005 | 0.004 | 0.008 | 0.002 | 0.004 | 0.002 | 0.006 | 0.014 | 0.034 |
| Total | 3.019 | 3.004 | 3.019 | 3.012 | 3.007 | 3.000 | 3.003 | 3.036 | 3.021 | 3.007 |
| Mn/(Mn+Fe) | 0.860 | 0.869 | 0.875 | 0.868 | 0.876 | 0.860 | 0.862 | 0.874 | 0.877 | 0.825 |
| Ta/(Ta+Nb) | 0.462 | 0.495 | 0.487 | 0.484 | 0.469 | 0.465 | 0.502 | 0.582 | 0.547 | 0.203 |
| Comments: | | YG & YH same grain | | in cluster with cass. | BB - BE same grain minor patchy zonation | | | coarse part | fine part | |

| | Marko's pegmatite<br>94-44E2 | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HB | HI | HK | DA | DB | DC | DD | DE | DG | DH | DI | DX | DW | DJ | DK |
| FeO | 2.31 | 2.31 | 2.46 | 1.74 | 1.69 | 2.29 | 2.33 | 2.06 | 1.81 | 1.82 | 1.89 | 1.94 | 1.79 | 1.73 | 1.92 |
| MnO | 13.22 | 13.00 | 13.07 | 13.72 | 13.52 | 12.72 | 12.63 | 12.79 | 13.66 | 13.94 | 13.99 | 14.06 | 13.81 | 14.38 | 14.00 |
| TiO2 | 1.22 | 0.86 | 0.78 | 1.76 | 1.14 | 0.78 | 0.72 | 1.10 | 1.51 | 1.40 | 0.78 | 0.81 | 0.85 | 0.88 | 0.96 |
| Nb2O5 | 18.34 | 16.23 | 15.65 | 26.23 | 24.72 | 17.39 | 16.30 | 19.28 | 24.72 | 28.63 | 27.55 | 27.09 | 24.55 | 29.38 | 26.60 |
| Ta2O5 | 64.42 | 66.31 | 66.52 | 54.09 | 57.05 | 65.28 | 65.25 | 62.23 | 56.02 | 52.65 | 54.25 | 54.37 | 57.03 | 52.61 | 54.72 |
| SnO2 | 0.56 | 0.49 | 0.43 | 0.36 | 0.54 | 0.38 | 1.09 | 0.65 | 0.80 | 0.37 | 0.21 | 0.25 | 0.24 | 0.19 | 0.30 |
| WO3 | 0.00 | 0.00 | 0.00 | 0.79 | 0.76 | 0.57 | 0.53 | 0.70 | 0.77 | 0.74 | 0.80 | 0.81 | 0.80 | 0.85 | 0.81 |
| PbO | 0.12 | 0.10 | 0.02 | 0.18 | 0.12 | 0.12 | 0.05 | 0.13 | 0.13 | 0.07 | 0.04 | 0.08 | 0.17 | 0.15 | 0.09 |
| ThO2 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.06 | 0.06 | 0.06 | 0.01 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.02 |
| Bi2O3 | | | | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 |
| Sc2O3 | 0.02 | 0.03 | 0.06 | 0.07 | 0.02 | 0.04 | 0.08 | 0.08 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.17 | 0.00 |
| CaO | 0.05 | 0.05 | 0.04 | 0.05 | 0.12 | 0.11 | 0.03 | 0.09 | 0.04 | 0.01 | 0.03 | 0.03 | 0.05 | 0.03 | 0.07 |
| Total | 100.40 | 99.41 | 99.04 | 99.00 | 99.67 | 99.73 | 99.00 | 99.13 | 99.50 | 99.63 | 99.56 | 99.47 | 99.31 | 100.38 | 99.50 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.145 | 0.148 | 0.159 | 0.105 | 0.103 | 0.146 | 0.150 | 0.130 | 0.110 | 0.108 | 0.114 | 0.117 | 0.110 | 0.102 | 0.116 |
| Mn | 0.839 | 0.845 | 0.855 | 0.838 | 0.833 | 0.820 | 0.824 | 0.816 | 0.839 | 0.838 | 0.852 | 0.858 | 0.857 | 0.860 | 0.856 |
| Ti | 0.069 | 0.050 | 0.045 | 0.095 | 0.062 | 0.044 | 0.042 | 0.062 | 0.082 | 0.075 | 0.042 | 0.044 | 0.047 | 0.047 | 0.052 |
| Nb | 0.621 | 0.563 | 0.547 | 0.855 | 0.813 | 0.598 | 0.567 | 0.657 | 0.811 | 0.919 | 0.895 | 0.883 | 0.813 | 0.937 | 0.868 |
| Ta | 1.312 | 1.384 | 1.398 | 1.060 | 1.128 | 1.351 | 1.366 | 1.275 | 1.105 | 1.017 | 1.061 | 1.066 | 1.136 | 1.009 | 1.074 |
| Sn | 0.017 | 0.015 | 0.013 | 0.010 | 0.016 | 0.012 | 0.033 | 0.020 | 0.023 | 0.010 | 0.006 | 0.007 | 0.007 | 0.005 | 0.009 |
| W | 0.000 | 0.000 | 0.000 | 0.015 | 0.014 | 0.011 | 0.010 | 0.014 | 0.014 | 0.014 | 0.015 | 0.015 | 0.015 | 0.016 | 0.015 |
| Pb | 0.002 | 0.002 | 0.000 | 0.004 | 0.002 | 0.002 | 0.001 | 0.003 | 0.003 | 0.001 | 0.001 | 0.002 | 0.003 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Bi | | | | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.004 | 0.001 | 0.002 | 0.005 | 0.005 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.011 | 0.000 |
| Ca | 0.004 | 0.004 | 0.003 | 0.004 | 0.009 | 0.009 | 0.002 | 0.007 | 0.003 | 0.001 | 0.002 | 0.002 | 0.004 | 0.002 | 0.006 |
| Total | 3.012 | 3.013 | 3.023 | 2.990 | 2.981 | 2.996 | 3.001 | 2.989 | 2.992 | 2.984 | 2.988 | 2.995 | 2.992 | 2.992 | 2.997 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.853 | 0.851 | 0.843 | 0.889 | 0.890 | 0.849 | 0.846 | 0.863 | 0.884 | 0.886 | 0.882 | 0.880 | 0.886 | 0.894 | 0.881 |
| Ta/(Ta+Nb) | 0.679 | 0.711 | 0.719 | 0.554 | 0.581 | 0.693 | 0.707 | 0.660 | 0.577 | 0.525 | 0.542 | 0.547 | 0.583 | 0.519 | 0.553 |
| Comments: | same area as DE | | | DA - DH exsolution in microlite<br>DC & DD same inclusion | | | | core of incl. in microlite | | | DI & DX rim to DE | | same as DI | exsolution in microlite | |

## Columbite-Tantalite Group

| | | | | | | | Marko's pegmatite | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 94-44E2 | | | | | | | | |
| | DL | DR | DM | DN | DO | DP | DQ | DS | DT | DU | EA | EB | EI | EJ | EK |
| FeO | 2.10 | 1.99 | 1.81 | 2.09 | 1.88 | 1.96 | 2.04 | 2.21 | 2.45 | 2.09 | 2.20 | 2.05 | 1.77 | 2.21 | 2.15 |
| MnO | 14.35 | 12.44 | 14.41 | 14.04 | 13.77 | 13.23 | 14.34 | 13.05 | 12.41 | 13.68 | 12.84 | 12.91 | 13.20 | 12.79 | 12.84 |
| TiO2 | 0.71 | 0.98 | 0.85 | 0.84 | 2.05 | 0.71 | 0.86 | 1.10 | 0.62 | 0.82 | 0.69 | 0.71 | 0.60 | 0.67 | 0.70 |
| Nb2O5 | 31.13 | 19.57 | 29.44 | 27.88 | 27.88 | 19.88 | 31.30 | 19.14 | 16.11 | 26.83 | 16.89 | 16.85 | 16.90 | 16.63 | 16.80 |
| Ta2O5 | 50.15 | 61.17 | 51.75 | 53.77 | 51.04 | 61.85 | 50.38 | 62.45 | 66.63 | 54.89 | 66.02 | 65.45 | 66.61 | 65.62 | 65.80 |
| SnO2 | 0.15 | 0.45 | 0.25 | 0.25 | 1.18 | 1.04 | 0.17 | 0.54 | 0.76 | 0.24 | 0.44 | 0.55 | 0.27 | 1.04 | 0.45 |
| WO3 | 0.84 | 0.65 | 0.90 | 0.82 | 0.89 | 0.51 | 0.83 | 0.64 | 0.48 | 0.73 | 0.58 | 0.62 | 0.43 | 0.55 | 0.54 |
| PbO | 0.12 | 0.16 | 0.11 | 0.11 | 0.11 | 0.12 | 0.16 | 0.09 | 0.02 | 0.18 | 0.10 | 0.14 | 0.13 | 0.10 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.46 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.06 | 0.03 | 0.00 | 0.31 | 0.04 | 0.06 | 0.16 | 0.06 | 0.01 | 0.07 | 0.15 | 0.09 | 0.00 | 0.15 | 0.00 |
| CaO | 0.02 | 0.73 | 0.02 | 0.03 | 0.03 | 0.01 | 0.03 | 0.01 | 0.15 | 0.01 | 0.03 | 0.04 | 0.03 | 0.03 | 0.02 |
| Total | 99.65 | 98.72 | 99.53 | 100.13 | 98.89 | 99.39 | 100.29 | 99.30 | 99.72 | 99.53 | 99.95 | 99.39 | 99.94 | 99.80 | 99.51 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.124 | 0.125 | 0.107 | 0.124 | 0.112 | 0.123 | 0.119 | 0.139 | 0.157 | 0.126 | 0.140 | 0.131 | 0.113 | 0.141 | 0.138 |
| Mn | 0.856 | 0.796 | 0.868 | 0.847 | 0.830 | 0.843 | 0.849 | 0.832 | 0.807 | 0.837 | 0.828 | 0.837 | 0.854 | 0.827 | 0.833 |
| Ti | 0.038 | 0.056 | 0.046 | 0.045 | 0.110 | 0.040 | 0.045 | 0.062 | 0.036 | 0.044 | 0.040 | 0.041 | 0.034 | 0.039 | 0.040 |
| Nb | 0.991 | 0.668 | 0.946 | 0.898 | 0.897 | 0.676 | 0.989 | 0.652 | 0.559 | 0.876 | 0.582 | 0.583 | 0.583 | 0.574 | 0.582 |
| Ta | 0.961 | 1.257 | 1.000 | 1.041 | 0.988 | 1.265 | 0.957 | 1.279 | 1.390 | 1.078 | 1.367 | 1.363 | 1.383 | 1.362 | 1.370 |
| Sn | 0.004 | 0.013 | 0.007 | 0.007 | 0.033 | 0.031 | 0.005 | 0.016 | 0.023 | 0.007 | 0.013 | 0.017 | 0.008 | 0.032 | 0.014 |
| W | 0.015 | 0.013 | 0.017 | 0.015 | 0.016 | 0.010 | 0.015 | 0.013 | 0.010 | 0.014 | 0.011 | 0.012 | 0.009 | 0.011 | 0.011 |
| Pb | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.000 | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.002 | 0.000 | 0.019 | 0.002 | 0.004 | 0.010 | 0.004 | 0.001 | 0.004 | 0.010 | 0.006 | 0.000 | 0.010 | 0.000 |
| Ca | 0.002 | 0.059 | 0.001 | 0.003 | 0.002 | 0.000 | 0.003 | 0.001 | 0.012 | 0.000 | 0.002 | 0.003 | 0.002 | 0.003 | 0.001 |
| Total | 2.997 | 3.008 | 2.994 | 3.000 | 2.994 | 2.995 | 2.995 | 2.999 | 2.997 | 2.989 | 2.996 | 2.996 | 2.990 | 3.000 | 2.995 |
| Mn/(Mn+Fe) | 0.874 | 0.864 | 0.890 | 0.872 | 0.881 | 0.872 | 0.877 | 0.857 | 0.837 | 0.869 | 0.856 | 0.865 | 0.883 | 0.854 | 0.858 |
| Ta/(Ta+Nb) | 0.492 | 0.653 | 0.514 | 0.537 | 0.524 | 0.652 | 0.492 | 0.662 | 0.713 | 0.552 | 0.702 | 0.700 | 0.703 | 0.704 | 0.702 |
| Comments: | DL & DR<br>col. part<br>rest microlite | | exsolution<br>in microlite | over-<br>growth<br>on microlite | exsol. | DP & DQ same grain<br>core | rim | | DT & DU<br>large inclusion<br>in microlite | | EA - EK large primary Mn col.<br>enclosed by microlite | | | | |

| | | | | | | | | **Marko's pegmatite** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 94-44E2 | | | | | | | |
| | EC | ED | EE | EH | EL | EM | AC | AD | AE | AF | AG | AH | AI | AJ | AK |
| FeO | 2.03 | 1.98 | 1.89 | 2.06 | 1.80 | 1.88 | 2.81 | 2.80 | 2.05 | 2.21 | 2.04 | 2.31 | 2.21 | 2.24 | 2.16 |
| MnO | 13.71 | 13.78 | 13.86 | 13.50 | 13.99 | 13.70 | 15.33 | 15.37 | 13.41 | 14.75 | 14.25 | 13.09 | 13.16 | 13.12 | 14.90 |
| TiO2 | 1.29 | 1.07 | 0.78 | 1.62 | 1.61 | 1.64 | 0.77 | 1.05 | 0.80 | 0.47 | 0.46 | 0.94 | 1.07 | 1.03 | 0.48 |
| Nb2O5 | 26.31 | 27.11 | 24.80 | 26.00 | 26.80 | 26.49 | 48.78 | 50.12 | 21.36 | 35.65 | 29.74 | 20.22 | 19.55 | 19.95 | 36.76 |
| Ta2O5 | 54.73 | 54.10 | 56.85 | 54.45 | 53.41 | 53.95 | 30.85 | 28.61 | 61.00 | 46.31 | 52.46 | 62.07 | 62.88 | 62.51 | 45.02 |
| SnO2 | 0.64 | 0.26 | 0.20 | 0.56 | 0.40 | 0.55 | 0.15 | 0.24 | 0.29 | 0.13 | 0.10 | 0.32 | 0.40 | 0.37 | 0.13 |
| WO3 | 0.69 | 0.83 | 0.76 | 0.96 | 0.87 | 0.79 | 0.74 | 0.80 | 0.53 | 0.60 | 0.49 | 0.50 | 0.57 | 0.49 | 0.54 |
| PbO | 0.15 | 0.18 | 0.11 | 0.19 | 0.06 | 0.13 | 0.00 | 0.20 | 0.10 | 0.20 | 0.17 | 0.09 | 0.14 | 0.22 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| Sb2O3 | 0.01 | 0.04 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.14 | 0.01 | 0.04 | 0.03 | 0.29 | 0.18 | 0.02 | 0.00 | 0.10 | 0.07 | 0.11 | 0.00 | 0.09 | 0.06 | 0.00 |
| CaO | 0.05 | 0.02 | 0.04 | 0.04 | 0.03 | 0.02 | 0.01 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.02 | 0.02 | 0.00 |
| Total | 99.77 | 99.38 | 99.36 | 99.42 | 99.30 | 99.34 | 99.46 | 99.20 | 99.65 | 100.40 | 99.86 | 99.60 | 100.12 | 100.01 | 100.13 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.122 | 0.119 | 0.116 | 0.124 | 0.108 | 0.113 | 0.151 | 0.150 | 0.127 | 0.127 | 0.121 | 0.144 | 0.138 | 0.140 | 0.123 |
| Mn | 0.834 | 0.840 | 0.858 | 0.823 | 0.848 | 0.833 | 0.835 | 0.832 | 0.845 | 0.856 | 0.858 | 0.830 | 0.832 | 0.829 | 0.862 |
| Ti | 0.070 | 0.058 | 0.043 | 0.088 | 0.087 | 0.088 | 0.037 | 0.051 | 0.045 | 0.024 | 0.025 | 0.053 | 0.060 | 0.058 | 0.024 |
| Nb | 0.854 | 0.883 | 0.820 | 0.846 | 0.867 | 0.859 | 1.418 | 1.448 | 0.718 | 1.105 | 0.956 | 0.684 | 0.660 | 0.673 | 1.135 |
| Ta | 1.069 | 1.060 | 1.130 | 1.066 | 1.040 | 1.053 | 0.539 | 0.497 | 1.233 | 0.863 | 1.014 | 1.263 | 1.276 | 1.268 | 0.836 |
| Sn | 0.018 | 0.008 | 0.006 | 0.016 | 0.012 | 0.016 | 0.004 | 0.006 | 0.008 | 0.004 | 0.003 | 0.009 | 0.012 | 0.011 | 0.003 |
| W | 0.013 | 0.015 | 0.014 | 0.018 | 0.016 | 0.015 | 0.012 | 0.013 | 0.010 | 0.011 | 0.009 | 0.010 | 0.011 | 0.009 | 0.009 |
| Pb | 0.003 | 0.003 | 0.002 | 0.004 | 0.001 | 0.003 | 0.000 | 0.003 | 0.002 | 0.004 | 0.003 | 0.002 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.009 | 0.001 | 0.003 | 0.002 | 0.018 | 0.011 | 0.001 | 0.000 | 0.006 | 0.004 | 0.007 | 0.000 | 0.006 | 0.004 | 0.000 |
| Ca | 0.004 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 |
| Total | 2.996 | 2.989 | 2.996 | 2.990 | 2.999 | 2.993 | 2.998 | 3.000 | 2.996 | 2.997 | 2.997 | 2.998 | 2.999 | 2.998 | 2.997 |
| Mn/(Mn+Fe) | 0.873 | 0.876 | 0.881 | 0.869 | 0.887 | 0.881 | 0.847 | 0.847 | 0.869 | 0.871 | 0.876 | 0.852 | 0.858 | 0.856 | 0.875 |
| Ta/(Ta+Nb) | 0.556 | 0.546 | 0.580 | 0.557 | 0.545 | 0.551 | 0.276 | 0.256 | 0.632 | 0.439 | 0.515 | 0.649 | 0.659 | 0.653 | 0.424 |

Comments: EC - EM dark rim not mantled by microlite
patchy replacement composition of EA - EK

AC - AK same grain
complex multi-phase growth
part horizontal trend and part vertical trend on quadrilateral

**Marko's pegmatite**

94-44E2

| | AL1 | AL2 | AL3 | AL4 | AL5 | AL6 | AL7 | AL8 | AL9 | AL10 | AL11 | AL12 | AL13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 1.87 | 2.05 | 2.18 | 2.16 | 2.21 | 2.22 | 2.64 | 2.76 | 2.84 | 2.82 | 2.86 | 2.38 | 2.85 |
| MnO | 13.63 | 13.45 | 13.19 | 13.32 | 13.34 | 13.05 | 15.73 | 15.72 | 15.71 | 15.38 | 13.43 | 13.92 | 15.74 |
| TiO2 | 0.74 | 0.98 | 0.94 | 0.94 | 0.94 | 0.95 | 0.99 | 0.69 | 0.76 | 0.72 | 0.77 | 0.68 | 0.62 |
| Nb2O5 | 20.21 | 19.99 | 20.22 | 20.38 | 20.92 | 21.45 | 52.14 | 52.06 | 52.45 | 49.13 | 50.14 | 29.01 | 52.13 |
| Ta2O5 | 62.28 | 61.71 | 61.71 | 62.15 | 61.63 | 60.65 | 26.47 | 26.64 | 26.25 | 29.74 | 27.33 | 51.94 | 26.59 |
| SnO2 | 0.40 | 0.36 | 0.34 | 0.35 | 0.41 | 0.39 | 0.22 | 0.11 | 0.15 | 0.11 | 0.20 | 0.18 | 0.15 |
| WO3 | 0.56 | 0.60 | 0.54 | 0.50 | 0.53 | 0.58 | 0.77 | 0.66 | 0.71 | 0.74 | 0.65 | 0.56 | 0.75 |
| PbO | 0.12 | 0.11 | 0.07 | 0.10 | 0.13 | 0.11 | 0.33 | 0.28 | 0.31 | 0.27 | 0.28 | 0.17 | 0.23 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.01 | 0.00 | 0.16 | 0.02 | 0.02 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.08 | 0.00 | 0.09 | 0.04 | 0.09 | 0.14 | 0.00 | 0.10 | 0.04 | 0.08 | 0.05 | 0.17 |
| CaO | 0.02 | 0.02 | 0.00 | 0.04 | 0.00 | 0.05 | 0.03 | 0.05 | 0.03 | 0.01 | 1.62 | 0.02 | 0.02 |
| Total | 99.90 | 99.36 | 99.20 | 100.00 | 100.13 | 99.55 | 99.49 | 98.96 | 99.30 | 98.95 | 97.51 | 98.93 | 99.25 |

**Structural formulae based on 6 oxygens**

| | AL1 | AL2 | AL3 | AL4 | AL5 | AL6 | AL7 | AL8 | AL9 | AL10 | AL11 | AL12 | AL13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.117 | 0.128 | 0.137 | 0.135 | 0.137 | 0.138 | 0.140 | 0.147 | 0.150 | 0.152 | 0.155 | 0.143 | 0.151 |
| Mn | 0.863 | 0.854 | 0.839 | 0.840 | 0.838 | 0.821 | 0.841 | 0.847 | 0.841 | 0.840 | 0.735 | 0.846 | 0.845 |
| Ti | 0.042 | 0.055 | 0.053 | 0.052 | 0.052 | 0.053 | 0.047 | 0.033 | 0.036 | 0.035 | 0.037 | 0.037 | 0.029 |
| Nb | 0.683 | 0.677 | 0.686 | 0.686 | 0.701 | 0.720 | 1.488 | 1.497 | 1.500 | 1.433 | 1.465 | 0.941 | 1.494 |
| Ta | 1.265 | 1.258 | 1.260 | 1.258 | 1.243 | 1.225 | 0.454 | 0.461 | 0.452 | 0.522 | 0.480 | 1.013 | 0.458 |
| Sn | 0.012 | 0.011 | 0.010 | 0.010 | 0.012 | 0.011 | 0.006 | 0.003 | 0.004 | 0.003 | 0.005 | 0.005 | 0.004 |
| W | 0.011 | 0.012 | 0.011 | 0.010 | 0.010 | 0.011 | 0.013 | 0.011 | 0.012 | 0.012 | 0.011 | 0.010 | 0.012 |
| Pb | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.006 | 0.005 | 0.005 | 0.005 | 0.005 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.005 | 0.000 | 0.006 | 0.002 | 0.006 | 0.008 | 0.000 | 0.006 | 0.002 | 0.005 | 0.003 | 0.009 |
| Ca | 0.002 | 0.002 | 0.000 | 0.003 | 0.000 | 0.004 | 0.002 | 0.003 | 0.002 | 0.000 | 0.112 | 0.002 | 0.001 |
| Total | 3.000 | 3.005 | 2.997 | 3.000 | 2.998 | 2.992 | 3.004 | 3.006 | 3.007 | 3.005 | 3.014 | 3.004 | 3.009 |
| Mn/(Mn+Fe) | 0.881 | 0.869 | 0.860 | 0.862 | 0.859 | 0.856 | 0.858 | 0.852 | 0.849 | 0.847 | 0.826 | 0.856 | 0.848 |
| Ta/(Ta+Nb) | 0.650 | 0.650 | 0.647 | 0.647 | 0.639 | 0.630 | 0.234 | 0.235 | 0.231 | 0.267 | 0.247 | 0.518 | 0.235 |

Comments:

AL traverse 700 μm euhedral grain
2 distinct parts - patchy then Ta-rich overgrowth at each end
part horizontal trend and part vertical trend on quadrilateral

**Marko's pegmatite**

94-44E2

| | AL14 | AL15 | AL16 | AL17 | AL18 | AL19 | AL20 | AM2 | AM3 | AM4 | AM5 | AN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.85 | 2.90 | 2.73 | 2.41 | 2.11 | 2.12 | 2.11 | 2.28 | 2.77 | 3.45 | 4.08 | 2.53 |
| MnO | 15.48 | 15.60 | 15.72 | 12.88 | 13.10 | 13.33 | 13.23 | 12.73 | 15.44 | 14.84 | 13.94 | 15.69 |
| TiO2 | 0.68 | 0.68 | 0.94 | 0.86 | 0.90 | 0.92 | 0.92 | 0.61 | 0.86 | 1.19 | 1.22 | 1.20 |
| Nb2O5 | 51.63 | 51.44 | 51.48 | 20.89 | 20.01 | 19.68 | 18.78 | 16.35 | 48.47 | 50.02 | 50.47 | 50.18 |
| Ta2O5 | 27.42 | 27.39 | 26.63 | 60.58 | 61.91 | 62.53 | 63.70 | 66.37 | 30.26 | 27.87 | 28.01 | 27.41 |
| SnO2 | 0.11 | 0.19 | 0.27 | 0.35 | 0.38 | 0.37 | 0.34 | 0.38 | 0.18 | 0.24 | 0.29 | 0.25 |
| WO3 | 0.54 | 0.62 | 0.88 | 0.53 | 0.49 | 0.54 | 0.50 | 0.47 | 0.80 | 0.84 | 0.70 | 0.85 |
| PbO | 0.26 | 0.24 | 0.27 | 0.15 | 0.12 | 0.12 | 0.11 | 0.16 | 0.26 | 0.28 | 0.28 | 0.31 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.05 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.27 | 0.17 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.11 | 0.06 | 0.04 | 0.02 | 0.00 | 0.00 | 0.03 | 0.05 | 0.06 | 0.21 | 0.06 | 0.16 |
| CaO | 0.04 | 0.02 | 0.01 | 0.13 | 0.20 | 0.02 | 0.00 | 0.02 | 0.01 | 0.03 | 0.17 | 0.03 |
| Total | 99.11 | 99.15 | 98.98 | 99.05 | 99.39 | 99.63 | 99.74 | 99.42 | 99.10 | 98.97 | 99.25 | 98.63 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.152 | 0.154 | 0.145 | 0.151 | 0.132 | 0.133 | 0.133 | 0.147 | 0.149 | 0.184 | 0.217 | 0.135 |
| Mn | 0.834 | 0.842 | 0.847 | 0.817 | 0.833 | 0.847 | 0.844 | 0.830 | 0.844 | 0.802 | 0.752 | 0.850 |
| Ti | 0.032 | 0.033 | 0.045 | 0.049 | 0.051 | 0.052 | 0.052 | 0.035 | 0.042 | 0.057 | 0.058 | 0.058 |
| Nb | 1.486 | 1.481 | 1.480 | 0.708 | 0.679 | 0.668 | 0.640 | 0.569 | 1.414 | 1.444 | 1.452 | 1.452 |
| Ta | 0.475 | 0.474 | 0.461 | 1.235 | 1.263 | 1.276 | 1.305 | 1.388 | 0.531 | 0.484 | 0.485 | 0.477 |
| Sn | 0.003 | 0.005 | 0.007 | 0.010 | 0.011 | 0.011 | 0.010 | 0.012 | 0.005 | 0.006 | 0.007 | 0.006 |
| W | 0.009 | 0.010 | 0.015 | 0.010 | 0.010 | 0.011 | 0.010 | 0.009 | 0.013 | 0.014 | 0.011 | 0.014 |
| Pb | 0.004 | 0.004 | 0.005 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 | 0.005 | 0.005 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.008 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.003 | 0.002 | 0.001 | 0.000 | 0.000 | 0.002 | 0.003 | 0.003 | 0.012 | 0.003 | 0.009 |
| Ca | 0.003 | 0.001 | 0.001 | 0.010 | 0.016 | 0.001 | 0.000 | 0.001 | 0.001 | 0.002 | 0.011 | 0.002 |
| Total | 3.004 | 3.008 | 3.007 | 3.002 | 3.003 | 3.001 | 2.999 | 2.997 | 3.007 | 3.011 | 3.003 | 3.010 |
| Mn/(Mn+Fe) | 0.846 | 0.845 | 0.854 | 0.844 | 0.863 | 0.864 | 0.864 | 0.850 | 0.850 | 0.813 | 0.776 | 0.863 |
| Ta/(Ta+Nb) | 0.242 | 0.243 | 0.237 | 0.636 | 0.651 | 0.656 | 0.671 | 0.709 | 0.273 | 0.251 | 0.250 | 0.247 |
| Comments: | | | | | | | | AM traverse<br>dark patchy 3-5, Ta-rich overgrowth 2 | | | | minor<br>patchy |

**Marko's pegmatite**

**94-44E2**

| | AV1 | AV2 | AV3 | AV5 | AV6 | AV7 | AV8 | AV9 | AV10 |
|---|---|---|---|---|---|---|---|---|---|
| FeO | 1.94 | 2.07 | 2.04 | 2.13 | 2.19 | 2.11 | 2.10 | 2.22 | 2.20 |
| MnO | 13.49 | 13.37 | 13.06 | 12.49 | 12.74 | 12.32 | 12.81 | 12.93 | 12.91 |
| TiO2 | 0.81 | 0.79 | 0.58 | 0.75 | 0.71 | 0.66 | 0.65 | 0.65 | 0.68 |
| Nb2O5 | 22.72 | 22.59 | 17.42 | 15.16 | 16.02 | 16.32 | 16.62 | 16.81 | 16.82 |
| Ta2O5 | 59.62 | 59.87 | 64.95 | 65.60 | 65.95 | 65.45 | 66.15 | 65.84 | 65.95 |
| SnO2 | 0.41 | 0.17 | 0.78 | 2.58 | 1.58 | 0.68 | 1.03 | 0.27 | 0.24 |
| WO3 | 0.47 | 0.56 | 0.49 | 0.48 | 0.53 | 0.47 | 0.42 | 0.53 | 0.49 |
| PbO | 0.15 | 0.11 | 0.09 | 0.07 | 0.05 | 0.06 | 0.12 | 0.17 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 | 0.03 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.16 | 0.14 | 0.10 | 0.02 | 0.06 | 0.00 | 0.01 | 0.06 | 0.05 |
| CaO | 0.03 | 0.03 | 0.03 | 0.04 | 0.02 | 0.51 | 0.04 | 0.02 | 0.07 |
| Total | 99.79 | 99.72 | 99.52 | 99.30 | 99.89 | 99.01 | 99.95 | 99.51 | 99.55 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | |
| Fe | 0.120 | 0.128 | 0.130 | 0.137 | 0.140 | 0.136 | 0.134 | 0.142 | 0.141 |
| Mn | 0.841 | 0.836 | 0.844 | 0.817 | 0.826 | 0.804 | 0.829 | 0.839 | 0.837 |
| Ti | 0.045 | 0.044 | 0.033 | 0.043 | 0.041 | 0.038 | 0.037 | 0.038 | 0.039 |
| Nb | 0.757 | 0.754 | 0.601 | 0.529 | 0.554 | 0.568 | 0.574 | 0.582 | 0.582 |
| Ta | 1.194 | 1.202 | 1.347 | 1.377 | 1.372 | 1.371 | 1.374 | 1.371 | 1.373 |
| Sn | 0.012 | 0.005 | 0.024 | 0.079 | 0.048 | 0.021 | 0.031 | 0.008 | 0.007 |
| W | 0.009 | 0.011 | 0.010 | 0.010 | 0.011 | 0.009 | 0.008 | 0.010 | 0.010 |
| Pb | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.013 | 0.000 | 0.001 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.010 | 0.009 | 0.007 | 0.001 | 0.004 | 0.000 | 0.001 | 0.004 | 0.003 |
| Ca | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 | 0.042 | 0.003 | 0.002 | 0.005 |
| Total | 2.993 | 2.992 | 2.999 | 2.998 | 2.999 | 3.005 | 2.993 | 3.001 | 3.000 |
| Mn/(Mn+Fe) | 0.875 | 0.867 | 0.866 | 0.856 | 0.855 | 0.856 | 0.861 | 0.855 | 0.856 |
| Ta/(Ta+Nb) | 0.612 | 0.615 | 0.692 | 0.723 | 0.712 | 0.707 | 0.705 | 0.702 | 0.702 |

Comments: AV traverse - covers same part as 2 of AM traverse
very faint patchy zoning in Ta-rich overgrowth

| | Marko's pegmatite | | | | | Marko's | Marko's pegmatite | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44G | | | | | 94-44I | 94-44K | | | | | | | | |
| | IA | IB | IC | IE | IF | XO | CB | CF | ZJ | QA | QD | QE | QN | QP | QS |
| FeO | 5.52 | 7.21 | 6.77 | 6.22 | 6.55 | 11.65 | 5.03 | 4.55 | 3.37 | 3.22 | 3.21 | 3.33 | 2.99 | 3.02 | 3.10 |
| MnO | 12.89 | 11.82 | 11.94 | 11.60 | 11.72 | 5.73 | 12.31 | 11.94 | 13.13 | 14.41 | 13.23 | 13.02 | 13.29 | 13.29 | 13.25 |
| TiO2 | 0.91 | 1.17 | 1.86 | 1.16 | 1.92 | 1.01 | 1.91 | 2.74 | 2.08 | 1.47 | 1.06 | 1.46 | 1.70 | 1.16 | 1.26 |
| Nb2O5 | 51.45 | 49.99 | 53.17 | 51.02 | 52.60 | 45.38 | 40.32 | 29.36 | 26.32 | 39.97 | 25.50 | 26.48 | 27.21 | 25.94 | 25.74 |
| Ta2O5 | 28.68 | 29.01 | 25.14 | 29.09 | 25.69 | 33.52 | 39.73 | 49.91 | 54.13 | 38.66 | 56.07 | 53.38 | 52.45 | 54.68 | 54.46 |
| SnO2 | 0.25 | 0.22 | 0.35 | 0.28 | 0.39 | 0.24 | 0.72 | 0.69 | 0.42 | 0.33 | 0.37 | 0.45 | 0.51 | 0.39 | 0.40 |
| WO3 | 0.50 | 0.57 | 0.58 | 0.57 | 0.77 | 0.33 | 0.00 | 0.00 | 0.00 | 0.42 | 0.34 | 0.51 | 0.66 | 0.40 | 0.43 |
| PbO | 0.25 | 0.29 | 0.34 | 0.23 | 0.33 | 0.40 | 0.14 | 0.13 | 0.15 | 0.31 | 0.15 | 0.24 | 0.21 | 0.18 | 0.21 |
| ThO2 | 0.00 | 0.01 | 0.02 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.19 | 0.03 | 0.32 | 0.00 | 0.21 | 0.10 | 0.00 | 0.00 | 0.00 | 0.08 | 0.09 | 0.24 | 0.09 | 0.09 | 0.06 |
| Sb2O3 | 0.05 | 0.03 | 0.06 | 0.05 | 0.06 | 0.05 | | | | 0.06 | 0.08 | 0.23 | 0.06 | 0.08 | 0.08 |
| Bi2O3 | | | | | | | | | | | | | | | |
| Sc2O3 | 0.10 | 0.08 | 0.17 | 0.05 | 0.10 | 0.12 | 0.03 | 0.03 | 0.07 | 0.03 | 0.05 | 0.02 | 0.03 | 0.02 | 0.05 |
| CaO | 0.06 | 0.04 | 0.11 | 0.06 | 0.06 | 0.17 | 0.00 | 0.00 | 0.00 | 0.08 | 0.07 | 0.15 | 0.08 | 0.00 | 0.07 |
| Total | 100.85 | 100.47 | 100.83 | 100.34 | 100.41 | 98.70 | 100.19 | 99.35 | 99.67 | 99.07 | 100.23 | 99.51 | 99.28 | 99.25 | 99.11 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.290 | 0.381 | 0.350 | 0.328 | 0.340 | 0.641 | 0.278 | 0.266 | 0.201 | 0.181 | 0.193 | 0.200 | 0.179 | 0.183 | 0.188 |
| Mn | 0.686 | 0.633 | 0.625 | 0.620 | 0.617 | 0.319 | 0.689 | 0.707 | 0.794 | 0.819 | 0.808 | 0.793 | 0.805 | 0.816 | 0.814 |
| Ti | 0.043 | 0.056 | 0.086 | 0.055 | 0.090 | 0.050 | 0.095 | 0.144 | 0.112 | 0.074 | 0.057 | 0.079 | 0.091 | 0.063 | 0.069 |
| Nb | 1.461 | 1.429 | 1.485 | 1.455 | 1.478 | 1.350 | 1.205 | 0.928 | 0.849 | 1.212 | 0.831 | 0.860 | 0.880 | 0.850 | 0.844 |
| Ta | 0.490 | 0.499 | 0.422 | 0.499 | 0.434 | 0.600 | 0.714 | 0.949 | 1.050 | 0.705 | 1.099 | 1.043 | 1.020 | 1.077 | 1.074 |
| Sn | 0.006 | 0.006 | 0.009 | 0.007 | 0.010 | 0.006 | 0.019 | 0.019 | 0.012 | 0.009 | 0.011 | 0.013 | 0.015 | 0.011 | 0.012 |
| W | 0.008 | 0.009 | 0.009 | 0.009 | 0.012 | 0.006 | 0.000 | 0.000 | 0.000 | 0.007 | 0.006 | 0.009 | 0.012 | 0.008 | 0.008 |
| Pb | 0.004 | 0.005 | 0.006 | 0.004 | 0.006 | 0.007 | 0.002 | 0.002 | 0.003 | 0.006 | 0.003 | 0.005 | 0.004 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.003 | 0.000 | 0.004 | 0.000 | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.004 | 0.001 | 0.001 | 0.001 |
| Sb | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | | | | 0.002 | 0.002 | 0.007 | 0.002 | 0.002 | 0.002 |
| Bi | | | | | | | | | | | | | | | |
| Sc | 0.005 | 0.004 | 0.009 | 0.003 | 0.005 | 0.007 | 0.002 | 0.002 | 0.004 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.003 |
| Ca | 0.004 | 0.003 | 0.007 | 0.004 | 0.004 | 0.012 | 0.000 | 0.000 | 0.000 | 0.006 | 0.005 | 0.012 | 0.006 | 0.000 | 0.005 |
| Total | 3.002 | 3.026 | 3.015 | 2.986 | 3.001 | 3.002 | 3.006 | 3.019 | 3.025 | 3.023 | 3.020 | 3.026 | 3.017 | 3.016 | 3.024 |
| Mn/(Mn+Fe) | 0.703 | 0.624 | 0.641 | 0.654 | 0.644 | 0.333 | 0.713 | 0.727 | 0.798 | 0.819 | 0.807 | 0.798 | 0.818 | 0.817 | 0.812 |
| Ta/(Ta+Nb) | 0.251 | 0.259 | 0.221 | 0.255 | 0.227 | 0.308 | 0.372 | 0.506 | 0.553 | 0.368 | 0.569 | 0.548 | 0.537 | 0.559 | 0.560 |
| Comments: | | | | | | | CB, CF & CJ surround<br>a large cassiterite grain<br>all stuck to edge | | | | QD - QS surround a large cassiterite grain | | | | |
| | | | | | | | | | | | stuck to edge | partially mantled | stuck to edge | | partially mantled |

| | **Marko's pegmatite** | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44MU5 | | | | | | | | | | | | | |
| | **BA** | **BB** | **BC** | **BE** | **BF3** | **BF4** | **BF5** | **BF9** | **BF10** | **BF11** | **BF13** | **BF14** | **BF15** | **BF16** |
| FeO | 4.64 | 4.15 | 4.27 | 3.84 | 4.00 | 3.95 | 3.81 | 3.61 | 4.41 | 4.64 | 3.89 | 3.93 | 3.90 | 4.01 |
| MnO | 13.26 | 13.80 | 13.33 | 13.00 | 13.66 | 13.52 | 13.78 | 13.33 | 12.55 | 12.96 | 13.03 | 13.78 | 13.22 | 13.31 |
| TiO2 | 1.07 | 0.98 | 1.34 | 0.45 | 1.10 | 0.76 | 0.93 | 0.54 | 0.72 | 1.04 | 0.46 | 0.66 | 0.90 | 0.85 |
| Nb2O5 | 48.91 | 50.80 | 50.56 | 38.38 | 49.09 | 49.09 | 48.71 | 40.30 | 40.45 | 51.60 | 39.59 | 50.00 | 44.20 | 45.78 |
| Ta2O5 | 29.53 | 28.32 | 28.01 | 43.71 | 30.05 | 31.28 | 30.84 | 40.41 | 40.45 | 27.66 | 41.62 | 30.14 | 36.18 | 33.16 |
| SnO2 | 0.37 | 0.13 | 0.00 | 0.07 | 0.41 | 0.09 | 0.17 | 0.00 | 0.00 | 0.06 | 0.06 | 0.14 | 0.09 | 0.18 |
| WO3 | 0.96 | 0.38 | 0.77 | 0.22 | 0.72 | 0.48 | 0.61 | 0.57 | 0.63 | 0.75 | 0.61 | 0.44 | 0.53 | 0.72 |
| PbO | 0.52 | 0.49 | 0.44 | 0.19 | 0.51 | 0.00 | 0.71 | 0.49 | 0.47 | 0.32 | 0.36 | 0.00 | 0.71 | 0.46 |
| ThO2 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.57 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 0.29 |
| Sb2O3 | 0.14 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.08 | 0.00 | 0.01 | 0.07 |
| Bi2O3 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.28 | 0.41 | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 |
| Sc2O3 | 0.00 | 0.99 | 0.71 | 0.17 | 0.00 | 0.15 | 0.26 | 0.12 | 0.67 | 0.16 | 0.50 | 0.00 | 0.00 | 0.54 |
| CaO | | | | | | | | | | | | | | |
| Total | 100.00 | 100.11 | 99.42 | 100.04 | 99.53 | 99.32 | 99.89 | 99.67 | 100.81 | 99.18 | 100.21 | 99.09 | 99.99 | 99.74 |
| | | | | | | | | | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.249 | 0.219 | 0.226 | 0.218 | 0.215 | 0.213 | 0.205 | 0.204 | 0.245 | 0.247 | 0.219 | 0.211 | 0.215 | 0.219 |
| Mn | 0.720 | 0.737 | 0.715 | 0.747 | 0.743 | 0.736 | 0.749 | 0.761 | 0.706 | 0.697 | 0.741 | 0.750 | 0.737 | 0.735 |
| Ti | 0.052 | 0.046 | 0.064 | 0.023 | 0.053 | 0.037 | 0.045 | 0.027 | 0.036 | 0.050 | 0.023 | 0.032 | 0.044 | 0.041 |
| Nb | 1.417 | 1.448 | 1.448 | 1.176 | 1.424 | 1.427 | 1.414 | 1.228 | 1.215 | 1.482 | 1.202 | 1.452 | 1.315 | 1.349 |
| Ta | 0.515 | 0.486 | 0.483 | 0.806 | 0.524 | 0.547 | 0.538 | 0.741 | 0.731 | 0.478 | 0.760 | 0.526 | 0.648 | 0.588 |
| Sn | 0.009 | 0.003 | 0.000 | 0.002 | 0.011 | 0.002 | 0.004 | 0.000 | 0.000 | 0.001 | 0.002 | 0.004 | 0.002 | 0.005 |
| W | 0.016 | 0.006 | 0.013 | 0.004 | 0.012 | 0.008 | 0.010 | 0.010 | 0.011 | 0.012 | 0.011 | 0.007 | 0.009 | 0.012 |
| Pb | 0.009 | 0.008 | 0.007 | 0.003 | 0.009 | 0.000 | 0.012 | 0.009 | 0.008 | 0.005 | 0.006 | 0.000 | 0.013 | 0.008 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 |
| Sb | 0.004 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 |
| Sc | 0.000 | 0.054 | 0.039 | 0.010 | 0.000 | 0.009 | 0.015 | 0.007 | 0.039 | 0.009 | 0.029 | 0.000 | 0.000 | 0.031 |
| Ca | | | | | | | | | | | | | | |
| Total | 2.999 | 3.009 | 2.995 | 2.989 | 2.990 | 2.979 | 2.994 | 2.993 | 3.000 | 2.981 | 2.995 | 2.982 | 2.987 | 3.000 |
| | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.743 | 0.771 | 0.760 | 0.774 | 0.776 | 0.776 | 0.785 | 0.789 | 0.742 | 0.739 | 0.772 | 0.780 | 0.775 | 0.771 |
| Ta/(Ta+Nb) | 0.266 | 0.251 | 0.250 | 0.407 | 0.269 | 0.277 | 0.276 | 0.376 | 0.376 | 0.244 | 0.387 | 0.266 | 0.330 | 0.303 |
| | | | | | | | | | | | | | | |
| Comments: | BA - BF complex zoned grain contains monazite inclusions | | | spectacular patchy zonation light coloured BSE | | | | | | | | | | |

| | Marko's pegmatite | | | | | | | | | Marko's pegmatite | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44MU5 | | | | | | | | | 94-44MU5(2) | | | | | | |
| | **BF18** | **BF19** | **BF20** | **BH2** | **BH3** | **BH4** | **BH17** | **BH19** | **BH20** | **AG** | **AJ** | **AK** | **AL** | **AM4** | **AM6** | **AM7** |
| FeO | 4.07 | 3.90 | 3.94 | 6.51 | 7.15 | 7.62 | 7.70 | 7.25 | 7.27 | 8.43 | 7.87 | 7.46 | 7.45 | 7.60 | 7.75 | 7.57 |
| MnO | 13.58 | 13.10 | 13.18 | 10.95 | 10.40 | 9.66 | 9.50 | 9.75 | 10.10 | 9.05 | 9.58 | 9.89 | 10.11 | 9.87 | 9.48 | 9.58 |
| TiO2 | 1.17 | 0.88 | 0.77 | 2.21 | 2.22 | 2.89 | 2.92 | 2.53 | 1.91 | 3.17 | 2.65 | 2.67 | 2.50 | 2.97 | 2.83 | 2.77 |
| Nb2O5 | 50.82 | 43.37 | 43.92 | 51.28 | 51.38 | 50.52 | 51.06 | 50.82 | 51.73 | 49.69 | 50.62 | 51.14 | 51.42 | 49.98 | 50.10 | 50.22 |
| Ta2O5 | 28.58 | 37.03 | 36.85 | 25.79 | 25.80 | 25.33 | 25.76 | 25.72 | 26.04 | 25.17 | 26.20 | 24.97 | 25.16 | 25.81 | 25.79 | 25.49 |
| SnO2 | 0.12 | 0.12 | 0.13 | 0.42 | 0.44 | 0.35 | 0.17 | 0.70 | 0.27 | 0.62 | 0.22 | 0.41 | 0.79 | 0.32 | 0.53 | 0.53 |
| WO3 | 0.53 | 0.55 | 0.55 | 0.98 | 1.42 | 1.05 | 1.40 | 0.90 | 0.99 | 1.46 | 0.83 | 1.25 | 1.08 | 1.46 | 1.34 | 1.29 |
| PbO | 0.14 | 0.48 | 0.20 | 0.21 | 0.00 | 0.53 | 0.26 | 0.50 | 0.37 | 0.49 | 0.65 | 0.56 | 0.27 | 0.16 | 0.15 | 0.54 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.28 | 0.14 | 0.00 | 0.00 | 0.00 | 0.49 | 0.15 | 0.66 | 0.43 | 0.27 | 0.42 | 0.00 | 0.00 |
| Sb2O3 | 0.07 | 0.00 | 0.07 | 0.00 | 0.15 | 0.19 | 0.00 | 0.00 | 0.05 | 0.27 | 0.00 | 0.00 | 0.00 | 0.07 | 0.21 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.24 | 0.00 | 0.00 | 0.06 | 0.37 | 0.23 | 0.00 | 0.15 | 0.00 | 0.47 | 0.05 | 0.00 | 0.00 | 0.36 |
| Sc2O3 | 0.00 | 0.33 | 0.00 | 1.23 | 0.55 | 0.98 | 0.52 | 0.75 | 0.41 | 0.29 | 0.00 | 0.00 | 0.61 | 0.17 | 0.85 | 1.21 |
| CaO | | | | | | | | | | | | | | | | |
| Total | 99.06 | 99.75 | 99.85 | 99.84 | 99.65 | 99.18 | 99.67 | 99.15 | 99.63 | 99.09 | 99.29 | 99.24 | 99.71 | 99.06 | 99.03 | 99.54 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.217 | 0.215 | 0.217 | 0.339 | 0.374 | 0.399 | 0.401 | 0.381 | 0.382 | 0.444 | 0.416 | 0.393 | 0.388 | 0.401 | 0.406 | 0.396 |
| Mn | 0.733 | 0.732 | 0.736 | 0.577 | 0.550 | 0.512 | 0.502 | 0.519 | 0.537 | 0.483 | 0.512 | 0.528 | 0.534 | 0.527 | 0.504 | 0.507 |
| Ti | 0.056 | 0.043 | 0.038 | 0.103 | 0.104 | 0.136 | 0.137 | 0.119 | 0.090 | 0.150 | 0.126 | 0.127 | 0.117 | 0.141 | 0.134 | 0.130 |
| Nb | 1.465 | 1.293 | 1.309 | 1.443 | 1.451 | 1.429 | 1.439 | 1.443 | 1.468 | 1.415 | 1.445 | 1.457 | 1.449 | 1.424 | 1.421 | 1.419 |
| Ta | 0.495 | 0.664 | 0.661 | 0.436 | 0.438 | 0.431 | 0.437 | 0.439 | 0.445 | 0.431 | 0.450 | 0.428 | 0.426 | 0.442 | 0.440 | 0.433 |
| Sn | 0.003 | 0.003 | 0.003 | 0.010 | 0.011 | 0.009 | 0.004 | 0.017 | 0.007 | 0.016 | 0.006 | 0.010 | 0.020 | 0.008 | 0.013 | 0.013 |
| W | 0.009 | 0.009 | 0.009 | 0.016 | 0.023 | 0.017 | 0.023 | 0.015 | 0.016 | 0.024 | 0.014 | 0.020 | 0.018 | 0.024 | 0.022 | 0.021 |
| Pb | 0.002 | 0.008 | 0.004 | 0.003 | 0.000 | 0.009 | 0.004 | 0.009 | 0.006 | 0.008 | 0.011 | 0.009 | 0.005 | 0.003 | 0.003 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.004 | 0.002 | 0.000 | 0.000 | 0.000 | 0.007 | 0.002 | 0.009 | 0.006 | 0.004 | 0.006 | 0.000 | 0.000 |
| Sb | 0.002 | 0.000 | 0.002 | 0.000 | 0.004 | 0.005 | 0.000 | 0.000 | 0.001 | 0.007 | 0.000 | 0.000 | 0.000 | 0.002 | 0.005 | 0.000 |
| Bi | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.001 | 0.006 | 0.004 | 0.000 | 0.002 | 0.000 | 0.008 | 0.001 | 0.000 | 0.000 | 0.006 |
| Sc | 0.000 | 0.019 | 0.000 | 0.067 | 0.030 | 0.054 | 0.028 | 0.041 | 0.023 | 0.016 | 0.000 | 0.000 | 0.033 | 0.009 | 0.046 | 0.066 |
| Ca | | | | | | | | | | | | | | | | |
| Total | 2.982 | 2.988 | 2.983 | 2.999 | 2.987 | 3.001 | 2.982 | 2.987 | 2.982 | 3.000 | 2.989 | 2.986 | 2.994 | 2.989 | 2.993 | 3.000 |
| Mn/(Mn+Fe) | 0.772 | 0.773 | 0.772 | 0.630 | 0.596 | 0.562 | 0.556 | 0.577 | 0.585 | 0.521 | 0.552 | 0.573 | 0.579 | 0.568 | 0.553 | 0.562 |
| Ta/(Ta+Nb) | 0.253 | 0.339 | 0.335 | 0.232 | 0.232 | 0.232 | 0.233 | 0.233 | 0.232 | 0.234 | 0.237 | 0.227 | 0.227 | 0.237 | 0.236 | 0.234 |
| Comments: | | | | | BH large unzoned grain | | | | | | | | no zonation observed | | | |

**Marko's pegmatite**

94-44MU5(2)

| | AM8 | AM9 | AM12 | AM13 | AM14 | AM15 | AM16 | AM17 | AM18 | AN1 | AN2 | AN3 | AN4 | AN6 | AN7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 7.78 | 7.76 | 8.12 | 8.23 | 7.94 | 7.33 | 7.76 | 8.17 | 8.10 | 7.18 | 7.51 | 7.73 | 7.74 | 7.42 | 7.52 |
| MnO | 9.57 | 9.67 | 9.38 | 9.04 | 9.35 | 9.92 | 9.43 | 9.29 | 9.39 | 10.07 | 9.65 | 9.52 | 9.60 | 9.76 | 9.66 |
| TiO2 | 2.87 | 2.82 | 2.97 | 2.91 | 2.95 | 3.05 | 3.00 | 2.98 | 2.87 | 2.70 | 3.00 | 2.99 | 3.19 | 3.08 | 2.93 |
| Nb2O5 | 50.99 | 50.85 | 50.43 | 50.13 | 50.45 | 50.33 | 50.37 | 50.64 | 51.18 | 51.22 | 50.38 | 49.70 | 50.07 | 49.56 | 50.34 |
| Ta2O5 | 25.96 | 25.80 | 25.70 | 25.25 | 25.17 | 25.19 | 25.33 | 25.35 | 25.09 | 26.40 | 26.71 | 26.19 | 25.60 | 26.19 | 25.90 |
| SnO2 | 0.46 | 0.37 | 0.18 | 0.56 | 0.23 | 0.54 | 0.27 | 0.69 | 0.56 | 0.45 | 0.12 | 0.72 | 0.55 | 0.59 | 0.32 |
| WO3 | 1.46 | 1.12 | 0.78 | 1.17 | 1.35 | 0.82 | 1.35 | 0.63 | 1.13 | 1.14 | 1.16 | 0.74 | 1.48 | 1.26 | 1.19 |
| PbO | 0.69 | 0.27 | 0.27 | 0.30 | 0.32 | 0.25 | 0.71 | 0.79 | 0.66 | 0.19 | 0.04 | 0.67 | 0.40 | 0.44 | 0.58 |
| ThO2 | 0.04 | 0.00 | 0.00 | 0.10 | 0.00 | 0.41 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.59 | 0.37 | 1.10 | 0.61 | 0.47 | 0.12 | 0.00 | 0.16 | 0.42 | 0.46 | 0.00 | 0.34 | 0.34 | 0.24 |
| Sb2O3 | 0.13 | 0.17 | 0.14 | 0.16 | 0.08 | 0.00 | 0.09 | 0.03 | 0.06 | 0.00 | 0.26 | 0.23 | 0.20 | 0.12 | 0.00 |
| Bi2O3 | 0.09 | 0.00 | 0.00 | 0.20 | 0.00 | 0.53 | 0.18 | 0.09 | 0.49 | 0.00 | 0.00 | 0.00 | 0.19 | 0.01 | 0.11 |
| Sc2O3 | 0.78 | 0.20 | 1.35 | 0.69 | 0.77 | 0.34 | 0.39 | 0.19 | 0.07 | 0.00 | 0.00 | 0.50 | 0.37 | 0.44 | 0.50 |
| CaO | | | | | | | | | | | | | | | |
| Total | 100.82 | 99.62 | 99.68 | 99.82 | 99.22 | 99.17 | 99.00 | 99.00 | 99.79 | 99.76 | 99.27 | 98.99 | 99.75 | 99.21 | 99.29 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.402 | 0.406 | 0.422 | 0.431 | 0.416 | 0.386 | 0.408 | 0.430 | 0.424 | 0.375 | 0.395 | 0.408 | 0.405 | 0.391 | 0.395 |
| Mn | 0.501 | 0.513 | 0.494 | 0.480 | 0.496 | 0.529 | 0.503 | 0.495 | 0.498 | 0.534 | 0.514 | 0.508 | 0.509 | 0.521 | 0.514 |
| Ti | 0.134 | 0.133 | 0.139 | 0.137 | 0.139 | 0.144 | 0.142 | 0.141 | 0.135 | 0.127 | 0.142 | 0.142 | 0.150 | 0.146 | 0.138 |
| Nb | 1.425 | 1.440 | 1.417 | 1.420 | 1.429 | 1.433 | 1.434 | 1.442 | 1.448 | 1.449 | 1.432 | 1.417 | 1.416 | 1.411 | 1.429 |
| Ta | 0.437 | 0.439 | 0.435 | 0.430 | 0.429 | 0.431 | 0.434 | 0.434 | 0.427 | 0.449 | 0.457 | 0.449 | 0.435 | 0.449 | 0.442 |
| Sn | 0.011 | 0.009 | 0.005 | 0.014 | 0.006 | 0.014 | 0.007 | 0.017 | 0.014 | 0.011 | 0.003 | 0.018 | 0.014 | 0.015 | 0.008 |
| W | 0.023 | 0.018 | 0.012 | 0.019 | 0.022 | 0.013 | 0.022 | 0.010 | 0.018 | 0.019 | 0.019 | 0.012 | 0.024 | 0.021 | 0.019 |
| Pb | 0.012 | 0.005 | 0.004 | 0.005 | 0.005 | 0.004 | 0.012 | 0.013 | 0.011 | 0.003 | 0.001 | 0.011 | 0.007 | 0.007 | 0.010 |
| Th | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.006 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.008 | 0.005 | 0.015 | 0.009 | 0.007 | 0.002 | 0.000 | 0.002 | 0.006 | 0.006 | 0.000 | 0.005 | 0.005 | 0.003 |
| Sb | 0.003 | 0.004 | 0.003 | 0.004 | 0.002 | 0.000 | 0.002 | 0.001 | 0.002 | 0.000 | 0.007 | 0.006 | 0.005 | 0.003 | 0.000 |
| Bi | 0.001 | 0.000 | 0.000 | 0.003 | 0.000 | 0.009 | 0.003 | 0.001 | 0.008 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.002 |
| Sc | 0.042 | 0.011 | 0.073 | 0.038 | 0.042 | 0.018 | 0.022 | 0.011 | 0.004 | 0.000 | 0.000 | 0.028 | 0.020 | 0.024 | 0.027 |
| Ca | | | | | | | | | | | | | | | |
| Total | 2.992 | 2.987 | 3.010 | 2.997 | 2.994 | 2.994 | 2.991 | 2.999 | 2.992 | 2.972 | 2.975 | 3.000 | 2.993 | 2.991 | 2.989 |
| Mn/(Mn+Fe) | 0.555 | 0.558 | 0.539 | 0.527 | 0.544 | 0.578 | 0.552 | 0.535 | 0.540 | 0.587 | 0.566 | 0.555 | 0.557 | 0.571 | 0.566 |
| Ta/(Ta+Nb) | 0.234 | 0.234 | 0.235 | 0.233 | 0.231 | 0.231 | 0.232 | 0.231 | 0.228 | 0.237 | 0.242 | 0.241 | 0.235 | 0.241 | 0.236 |

Comments: no zonation observed

| | Marko's pegmatite | | | | | | | Marko's peg. | | | Marko's pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44MU5(2) | | | | | | | 94-44N1 | | | 94-44N2 | | | | | |
| | AN9 | AO44 | AO46 | AO47 | AO49 | AO50 | AO51 | AA | AC | AO | BB | BD | BE | BG | BH | BP |
| FeO | 7.76 | 7.73 | 8.15 | 8.10 | 7.53 | 8.08 | 7.73 | 3.47 | 3.11 | 3.44 | 6.70 | 6.61 | 6.32 | 7.01 | 8.13 | 7.04 |
| MnO | 9.66 | 9.90 | 9.26 | 9.39 | 9.73 | 9.37 | 9.47 | 13.92 | 12.43 | 13.65 | 11.72 | 11.37 | 11.81 | 11.66 | 10.23 | 11.18 |
| TiO2 | 2.79 | 2.94 | 2.89 | 2.69 | 3.04 | 2.57 | 3.23 | 3.05 | 2.52 | 3.24 | 2.67 | 2.84 | 3.74 | 2.47 | 2.37 | 2.33 |
| Nb2O5 | 49.41 | 49.92 | 51.07 | 51.70 | 51.11 | 51.88 | 50.67 | 39.24 | 32.68 | 36.32 | 49.06 | 48.02 | 47.19 | 49.73 | 51.99 | 50.04 |
| Ta2O5 | 26.53 | 26.27 | 25.34 | 24.78 | 25.07 | 25.36 | 25.30 | 37.74 | 45.00 | 38.98 | 28.33 | 28.29 | 27.16 | 26.57 | 23.62 | 25.52 |
| SnO2 | 0.50 | 0.34 | 0.47 | 0.50 | 0.44 | 0.51 | 0.42 | 1.09 | 0.72 | 0.95 | 0.57 | 0.60 | 0.55 | 0.41 | 0.47 | 0.55 |
| WO3 | 1.26 | 1.25 | 1.28 | 1.19 | 1.17 | 1.14 | 1.52 | 0.53 | 0.55 | 0.75 | 0.67 | 0.73 | 0.69 | 0.67 | 0.74 | 0.68 |
| PbO | 0.00 | 0.55 | 0.00 | 0.24 | 0.61 | 0.79 | 0.93 | 0.36 | 0.27 | 0.41 | 0.33 | 0.38 | 0.47 | 0.32 | 0.55 | 0.52 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.42 | 0.00 | 0.42 | 0.31 | 0.51 | 0.00 | 0.00 | 0.29 | 0.59 | 0.46 | 0.13 | 0.32 | 0.53 | 0.19 | 0.18 | 0.13 |
| Sb2O3 | 0.02 | 0.00 | 0.16 | 0.27 | 0.00 | 0.00 | 0.05 | | | | 0.06 | 0.10 | 0.05 | 0.10 | 0.05 | 0.06 |
| Bi2O3 | 0.49 | 0.45 | 0.00 | 0.04 | 0.37 | 0.25 | 0.00 | | | | | | | | | |
| Sc2O3 | 0.58 | 0.68 | 0.41 | 0.16 | 0.00 | 0.32 | 0.53 | | | | 0.07 | 0.12 | 0.08 | 0.08 | 0.17 | 0.15 |
| CaO | | | | | | | | 0.07 | 0.19 | 0.05 | 0.04 | 0.06 | 0.04 | 0.06 | 0.04 | 0.04 |
| Total | 99.43 | 100.02 | 99.43 | 99.35 | 99.58 | 100.29 | 99.85 | 99.69 | 97.87 | 98.21 | 100.35 | 99.46 | 98.63 | 99.27 | 98.51 | 98.20 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.409 | 0.404 | 0.425 | 0.423 | 0.395 | 0.420 | 0.403 | 0.192 | 0.181 | 0.195 | 0.352 | 0.351 | 0.337 | 0.370 | 0.428 | 0.375 |
| Mn | 0.515 | 0.524 | 0.490 | 0.497 | 0.517 | 0.493 | 0.500 | 0.779 | 0.735 | 0.783 | 0.623 | 0.611 | 0.637 | 0.624 | 0.545 | 0.603 |
| Ti | 0.132 | 0.138 | 0.136 | 0.127 | 0.143 | 0.120 | 0.151 | 0.151 | 0.132 | 0.165 | 0.126 | 0.136 | 0.179 | 0.117 | 0.112 | 0.112 |
| Nb | 1.407 | 1.411 | 1.441 | 1.461 | 1.448 | 1.459 | 1.427 | 1.171 | 1.031 | 1.112 | 1.393 | 1.378 | 1.358 | 1.420 | 1.479 | 1.441 |
| Ta | 0.454 | 0.446 | 0.430 | 0.421 | 0.427 | 0.429 | 0.429 | 0.678 | 0.854 | 0.718 | 0.484 | 0.488 | 0.470 | 0.456 | 0.404 | 0.442 |
| Sn | 0.013 | 0.008 | 0.012 | 0.012 | 0.011 | 0.013 | 0.011 | 0.029 | 0.020 | 0.026 | 0.014 | 0.015 | 0.014 | 0.010 | 0.012 | 0.014 |
| W | 0.021 | 0.020 | 0.021 | 0.019 | 0.019 | 0.018 | 0.025 | 0.009 | 0.010 | 0.013 | 0.011 | 0.012 | 0.011 | 0.011 | 0.012 | 0.011 |
| Pb | 0.000 | 0.009 | 0.000 | 0.004 | 0.010 | 0.013 | 0.016 | 0.006 | 0.005 | 0.007 | 0.006 | 0.006 | 0.008 | 0.005 | 0.009 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.006 | 0.000 | 0.006 | 0.004 | 0.007 | 0.000 | 0.000 | 0.004 | 0.009 | 0.007 | 0.002 | 0.005 | 0.008 | 0.003 | 0.003 | 0.002 |
| Sb | 0.001 | 0.000 | 0.004 | 0.007 | 0.000 | 0.000 | 0.001 | | | | 0.002 | 0.003 | 0.001 | 0.003 | 0.001 | 0.002 |
| Bi | 0.008 | 0.007 | 0.000 | 0.001 | 0.006 | 0.004 | 0.000 | | | | | | | | | |
| Sc | 0.032 | 0.037 | 0.022 | 0.008 | 0.000 | 0.017 | 0.029 | | | | 0.004 | 0.007 | 0.004 | 0.004 | 0.009 | 0.008 |
| Ca | | | | | | | | 0.005 | 0.014 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 |
| Total | 2.997 | 3.005 | 2.986 | 2.986 | 2.984 | 2.988 | 2.990 | 3.024 | 2.992 | 3.030 | 3.018 | 3.016 | 3.031 | 3.029 | 3.018 | 3.021 |
| Mn/(Mn+Fe) | 0.558 | 0.565 | 0.535 | 0.540 | 0.567 | 0.540 | 0.554 | 0.802 | 0.802 | 0.801 | 0.639 | 0.635 | 0.654 | 0.628 | 0.560 | 0.617 |
| Ta/(Ta+Nb) | 0.244 | 0.240 | 0.230 | 0.224 | 0.228 | 0.227 | 0.231 | 0.367 | 0.453 | 0.392 | 0.258 | 0.262 | 0.257 | 0.243 | 0.215 | 0.235 |
| Comments: | | | | | | | | acicular grain | acicular grain | | | | larger grains | | | |

| | Marko's pegmatite<br>94-44N2 | | | | | | | | | Marko's pegmatite<br>94-44P | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | BJ | BL | BM | BN | BO | BR | BS | BT | BV | DB | DE1 | DE2 |
| FeO | 3.31 | 3.96 | 3.47 | 4.13 | 4.11 | 4.93 | 4.23 | 4.30 | 4.20 | 4.99 | 2.44 | 2.37 |
| MnO | 15.25 | 14.48 | 14.80 | 14.39 | 14.07 | 13.43 | 14.35 | 14.31 | 14.28 | 13.19 | 17.53 | 15.88 |
| TiO2 | 1.20 | 1.20 | 1.18 | 1.30 | 2.31 | 2.23 | 0.86 | 1.73 | 2.11 | 2.15 | 1.22 | 1.35 |
| Nb2O5 | 52.62 | 52.05 | 51.26 | 53.27 | 49.19 | 50.95 | 52.44 | 53.96 | 52.61 | 49.12 | 49.17 | 50.25 |
| Ta2O5 | 25.32 | 25.53 | 27.20 | 23.74 | 26.70 | 25.01 | 25.72 | 22.67 | 23.39 | 28.01 | 28.26 | 28.69 |
| SnO2 | 0.09 | 0.24 | 0.14 | 0.16 | 0.50 | 0.46 | 0.22 | 0.36 | 0.44 | 0.46 | 0.13 | 0.25 |
| WO3 | 0.41 | 0.42 | 0.45 | 0.69 | 0.61 | 0.73 | 0.40 | 0.62 | 0.58 | 0.62 | 0.30 | 0.14 |
| PbO | 0.24 | 0.49 | 0.24 | 0.80 | 0.52 | 0.49 | 0.54 | 0.57 | 0.47 | 0.45 | 0.26 | 0.47 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.52 | 0.08 | 0.00 | 0.11 | 0.26 | 0.15 | 0.02 | 0.08 | 0.16 | 0.03 | 0.00 | 0.00 |
| Sb2O3 | 0.07 | 0.08 | 0.06 | 0.08 | 0.08 | 0.08 | 0.06 | 0.05 | 0.10 | 0.08 | 0.05 | 0.05 |
| Bi2O3 | | | | | | | | | | | | |
| Sc2O3 | 0.09 | 0.10 | 0.08 | 0.08 | 0.07 | 0.13 | 0.08 | 0.15 | 0.17 | 0.10 | 0.07 | 0.07 |
| CaO | 0.07 | 0.12 | 0.18 | 0.08 | 0.06 | 0.07 | 0.07 | 0.06 | 0.07 | 0.08 | 0.11 | 0.11 |
| Total | 99.19 | 98.75 | 99.06 | 98.87 | 98.43 | 98.60 | 98.92 | 98.81 | 98.52 | 99.20 | 99.43 | 99.65 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.175 | 0.210 | 0.184 | 0.218 | 0.220 | 0.261 | 0.224 | 0.225 | 0.221 | 0.265 | 0.130 | 0.126 |
| Mn | 0.815 | 0.778 | 0.796 | 0.769 | 0.761 | 0.719 | 0.771 | 0.758 | 0.760 | 0.710 | 0.946 | 0.854 |
| Ti | 0.057 | 0.057 | 0.056 | 0.062 | 0.111 | 0.106 | 0.041 | 0.081 | 0.100 | 0.103 | 0.058 | 0.065 |
| Nb | 1.501 | 1.493 | 1.471 | 1.519 | 1.421 | 1.457 | 1.504 | 1.525 | 1.494 | 1.412 | 1.417 | 1.443 |
| Ta | 0.434 | 0.441 | 0.470 | 0.407 | 0.464 | 0.430 | 0.444 | 0.385 | 0.400 | 0.484 | 0.490 | 0.496 |
| Sn | 0.002 | 0.006 | 0.004 | 0.004 | 0.013 | 0.012 | 0.006 | 0.009 | 0.011 | 0.012 | 0.003 | 0.006 |
| W | 0.007 | 0.007 | 0.007 | 0.011 | 0.010 | 0.012 | 0.007 | 0.010 | 0.009 | 0.010 | 0.005 | 0.002 |
| Pb | 0.004 | 0.008 | 0.004 | 0.014 | 0.009 | 0.008 | 0.009 | 0.010 | 0.008 | 0.008 | 0.004 | 0.008 |
| Th | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.007 | 0.001 | 0.000 | 0.002 | 0.004 | 0.002 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.002 | 0.001 | 0.001 |
| Bi | | | | | | | | | | | | |
| Sc | 0.005 | 0.006 | 0.004 | 0.004 | 0.004 | 0.007 | 0.004 | 0.008 | 0.009 | 0.006 | 0.004 | 0.004 |
| Ca | 0.005 | 0.008 | 0.012 | 0.005 | 0.004 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.008 | 0.008 |
| Total | 3.014 | 3.017 | 3.011 | 3.017 | 3.022 | 3.021 | 3.016 | 3.018 | 3.021 | 3.017 | 3.066 | 3.013 |
| Mn/(Mn+Fe) | 0.824 | 0.787 | 0.812 | 0.779 | 0.776 | 0.734 | 0.775 | 0.771 | 0.775 | 0.728 | 0.879 | 0.871 |
| Ta/(Ta+Nb) | 0.224 | 0.228 | 0.242 | 0.211 | 0.246 | 0.228 | 0.228 | 0.202 | 0.211 | 0.255 | 0.257 | 0.256 |
| Comments: | | | | | smaller grains | | | | | | | |

| | | **Marko's pegmatite** | | | | | | | | **Marko's pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 94-44R | | | | | | | | 94-44U | | | | | | |
| | DA | DE | DG | AA | AB | AC | QA | QB | QC | QD | QE | QF | QG | QI | QO | QQ |
| FeO | 2.10 | 2.02 | 1.98 | 3.84 | 4.14 | 6.75 | 3.37 | 4.35 | 6.64 | 3.88 | 4.68 | 4.81 | 3.68 | 5.58 | 3.51 | 7.00 |
| MnO | 15.29 | 14.85 | 15.03 | 14.64 | 14.25 | 11.42 | 15.30 | 13.89 | 11.48 | 14.31 | 13.47 | 13.32 | 14.76 | 12.70 | 14.99 | 10.83 |
| TiO2 | 0.82 | 0.82 | 0.77 | 2.28 | 1.83 | 2.98 | 1.37 | 1.75 | 2.41 | 1.78 | 1.91 | 1.80 | 1.40 | 1.83 | 0.91 | 3.18 |
| Nb2O5 | 27.03 | 30.06 | 31.83 | 50.58 | 47.54 | 48.10 | 50.13 | 47.98 | 48.41 | 47.73 | 48.38 | 47.70 | 49.05 | 47.91 | 49.08 | 46.37 |
| Ta2O5 | 53.95 | 50.81 | 50.52 | 26.47 | 29.79 | 27.79 | 29.15 | 30.09 | 29.31 | 30.94 | 30.68 | 29.91 | 30.09 | 31.18 | 31.18 | 30.81 |
| SnO2 | 0.15 | 0.15 | 0.11 | 0.28 | 0.38 | 0.60 | 0.30 | 0.46 | 0.61 | 0.47 | 0.44 | 0.46 | 0.27 | 0.49 | 0.22 | 0.77 |
| WO3 | 0.25 | 0.45 | 0.38 | 0.81 | 0.54 | 0.61 | 0.59 | 0.61 | 0.58 | 0.61 | 0.61 | 0.56 | 0.55 | 0.51 | 0.52 | 0.49 |
| PbO | 0.13 | 0.16 | 0.14 | 0.36 | 0.29 | 0.44 | 0.29 | 0.30 | 0.29 | 0.33 | 0.36 | 0.35 | 0.20 | 0.32 | 0.20 | 0.44 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.01 | 0.02 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.26 | 0.08 | 0.37 | 0.00 | 0.10 | 0.10 | 0.13 | 0.26 | 0.08 | 0.00 | 0.06 | 0.00 | 0.53 |
| Sb2O3 | | | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | | | |
| Sc2O3 | | | | 0.13 | 0.10 | 0.10 | 0.08 | 0.08 | 0.07 | 0.00 | 0.08 | 0.07 | 0.08 | 0.03 | 0.05 | 0.05 |
| CaO | 0.07 | 0.07 | 0.05 | 0.04 | 0.04 | 0.04 | 0.06 | 0.06 | 0.03 | 0.04 | 0.07 | 0.06 | 0.04 | 0.04 | 0.04 | 0.25 |
| Total | 99.72 | 99.32 | 100.76 | 99.70 | 99.01 | 99.22 | 100.65 | 99.68 | 99.93 | 100.23 | 100.94 | 99.12 | 100.13 | 100.67 | 100.71 | 100.74 |
| | | | | | | | | | | | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.126 | 0.120 | 0.115 | 0.202 | 0.223 | 0.359 | 0.178 | 0.233 | 0.352 | 0.207 | 0.247 | 0.259 | 0.196 | 0.296 | 0.187 | 0.370 |
| Mn | 0.930 | 0.892 | 0.885 | 0.779 | 0.776 | 0.614 | 0.816 | 0.752 | 0.616 | 0.773 | 0.721 | 0.725 | 0.794 | 0.683 | 0.807 | 0.580 |
| Ti | 0.044 | 0.044 | 0.040 | 0.108 | 0.089 | 0.142 | 0.065 | 0.084 | 0.115 | 0.085 | 0.091 | 0.087 | 0.067 | 0.087 | 0.043 | 0.151 |
| Nb | 0.877 | 0.964 | 1.000 | 1.437 | 1.382 | 1.381 | 1.427 | 1.387 | 1.386 | 1.376 | 1.382 | 1.386 | 1.409 | 1.375 | 1.410 | 1.326 |
| Ta | 1.053 | 0.980 | 0.955 | 0.452 | 0.521 | 0.480 | 0.499 | 0.523 | 0.505 | 0.537 | 0.527 | 0.523 | 0.520 | 0.538 | 0.539 | 0.530 |
| Sn | 0.004 | 0.004 | 0.003 | 0.007 | 0.010 | 0.015 | 0.008 | 0.012 | 0.015 | 0.012 | 0.011 | 0.012 | 0.007 | 0.012 | 0.006 | 0.019 |
| W | 0.005 | 0.008 | 0.007 | 0.013 | 0.009 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.009 | 0.009 | 0.008 | 0.009 | 0.008 |
| Pb | 0.003 | 0.003 | 0.003 | 0.006 | 0.005 | 0.008 | 0.005 | 0.005 | 0.005 | 0.006 | 0.006 | 0.006 | 0.003 | 0.005 | 0.003 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.004 | 0.001 | 0.005 | 0.000 | 0.001 | 0.001 | 0.002 | 0.004 | 0.001 | 0.000 | 0.001 | 0.000 | 0.007 |
| Sb | | | | | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | | | | | |
| Sc | | | | 0.007 | 0.006 | 0.006 | 0.004 | 0.004 | 0.004 | 0.000 | 0.004 | 0.004 | 0.004 | 0.002 | 0.003 | 0.003 |
| Ca | 0.005 | 0.005 | 0.004 | 0.003 | 0.003 | 0.003 | 0.004 | 0.004 | 0.002 | 0.003 | 0.005 | 0.004 | 0.003 | 0.003 | 0.003 | 0.017 |
| Total | 3.047 | 3.020 | 3.011 | 3.018 | 3.024 | 3.023 | 3.016 | 3.016 | 3.011 | 3.011 | 3.008 | 3.016 | 3.012 | 3.012 | 3.009 | 3.020 |
| | | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.881 | 0.882 | 0.885 | 0.794 | 0.777 | 0.631 | 0.821 | 0.764 | 0.637 | 0.789 | 0.745 | 0.737 | 0.802 | 0.697 | 0.812 | 0.610 |
| Ta/(Ta+Nb) | 0.546 | 0.504 | 0.488 | 0.239 | 0.274 | 0.258 | 0.259 | 0.274 | 0.267 | 0.281 | 0.276 | 0.274 | 0.270 | 0.281 | 0.276 | 0.286 |
| | | | | | | | | | | | | | | | | |
| Comments: | | forms cluster with cassiterite | | | manganocolumbite-rich sample | | | | QB-QE in cluster (QC latest) | | | | | | | incl. in garnet |

| | Marko's pegmatite | | | | Marko's pegmatite | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44U | | | | 94-44W | | | | | | | | | | | |
| | QS | QK | QL | QP | FA | FG | FN | PG | PH | PI | PJ | PL | PM | PN | PO | PQ |
| FeO | 6.88 | 4.99 | 7.76 | 6.62 | 6.86 | 3.68 | 3.38 | 5.29 | 6.49 | 5.44 | 3.00 | 5.55 | 5.49 | 4.14 | 4.36 | 4.06 |
| MnO | 11.12 | 13.13 | 10.24 | 12.02 | 11.26 | 13.91 | 14.60 | 12.50 | 11.19 | 12.44 | 15.14 | 12.30 | 12.20 | 13.48 | 13.47 | 14.03 |
| TiO2 | 2.87 | 2.44 | 3.12 | 2.69 | 3.26 | 2.77 | 2.28 | 3.61 | 3.30 | 3.45 | 1.28 | 3.58 | 3.31 | 3.62 | 3.78 | 2.46 |
| Nb2O5 | 48.95 | 53.04 | 51.38 | 53.09 | 47.06 | 41.62 | 45.80 | 46.56 | 48.04 | 47.02 | 46.48 | 48.35 | 45.54 | 47.47 | 46.06 | 44.52 |
| Ta2O5 | 28.40 | 24.31 | 24.51 | 23.99 | 28.83 | 35.36 | 31.26 | 29.38 | 28.33 | 29.29 | 33.28 | 28.07 | 30.26 | 29.72 | 29.85 | 32.40 |
| SnO2 | 0.52 | 0.58 | 0.41 | 0.36 | 0.66 | 0.80 | 0.39 | 0.78 | 0.61 | 0.77 | 0.22 | 0.86 | 0.75 | 0.83 | 0.86 | 0.69 |
| WO3 | 0.59 | 0.70 | 0.66 | 0.52 | 0.56 | 0.49 | 0.70 | 0.46 | 0.70 | 0.51 | 0.50 | 0.61 | 0.48 | 0.57 | 0.58 | 0.61 |
| PbO | 0.39 | 0.33 | 0.45 | 0.34 | 0.42 | 0.29 | 0.29 | 0.50 | 0.53 | 0.50 | 0.27 | 0.53 | 0.46 | 0.49 | 0.36 | 0.29 |
| ThO2 | 0.00 | 0.02 | 0.02 | 0.03 | 0.01 | 0.00 | 0.03 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.00 | 0.02 |
| UO2 | 0.26 | 0.58 | 0.45 | 0.21 | 0.37 | 0.26 | 0.13 | 0.44 | 0.52 | 0.50 | 0.02 | 0.37 | 0.44 | 0.37 | 0.24 | 0.00 |
| Sb2O3 | | | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | | | |
| Sc2O3 | 0.10 | 0.17 | 0.20 | 0.18 | | | | 0.08 | 0.07 | 0.10 | 0.05 | 0.05 | 0.08 | 0.05 | 0.10 | 0.05 |
| CaO | 0.04 | 0.06 | 0.03 | 0.03 | 0.03 | 0.11 | 0.10 | 0.03 | 0.03 | 0.02 | 0.04 | 0.07 | 0.08 | 0.02 | 0.03 | 0.04 |
| Total | 100.12 | 100.35 | 99.23 | 100.08 | 99.29 | 99.18 | 98.86 | 99.64 | 99.81 | 100.05 | 100.30 | 100.35 | 99.12 | 100.77 | 99.69 | 99.17 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.362 | 0.258 | 0.405 | 0.342 | 0.365 | 0.202 | 0.183 | 0.281 | 0.343 | 0.288 | 0.162 | 0.291 | 0.295 | 0.217 | 0.231 | 0.220 |
| Mn | 0.592 | 0.687 | 0.542 | 0.628 | 0.607 | 0.773 | 0.800 | 0.672 | 0.599 | 0.666 | 0.826 | 0.653 | 0.664 | 0.716 | 0.724 | 0.770 |
| Ti | 0.136 | 0.113 | 0.147 | 0.125 | 0.156 | 0.137 | 0.111 | 0.172 | 0.157 | 0.164 | 0.062 | 0.169 | 0.160 | 0.171 | 0.180 | 0.120 |
| Nb | 1.392 | 1.482 | 1.451 | 1.481 | 1.355 | 1.235 | 1.339 | 1.337 | 1.372 | 1.345 | 1.353 | 1.369 | 1.322 | 1.346 | 1.321 | 1.305 |
| Ta | 0.486 | 0.409 | 0.416 | 0.403 | 0.499 | 0.631 | 0.550 | 0.507 | 0.487 | 0.504 | 0.583 | 0.478 | 0.528 | 0.507 | 0.515 | 0.571 |
| Sn | 0.013 | 0.014 | 0.010 | 0.009 | 0.017 | 0.021 | 0.010 | 0.020 | 0.015 | 0.019 | 0.006 | 0.021 | 0.019 | 0.021 | 0.022 | 0.018 |
| W | 0.010 | 0.011 | 0.011 | 0.008 | 0.009 | 0.008 | 0.012 | 0.008 | 0.011 | 0.008 | 0.008 | 0.010 | 0.008 | 0.009 | 0.010 | 0.010 |
| Pb | 0.007 | 0.005 | 0.008 | 0.006 | 0.007 | 0.005 | 0.005 | 0.009 | 0.009 | 0.009 | 0.005 | 0.009 | 0.008 | 0.008 | 0.006 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.004 | 0.008 | 0.006 | 0.003 | 0.005 | 0.004 | 0.002 | 0.006 | 0.007 | 0.007 | 0.000 | 0.005 | 0.006 | 0.005 | 0.003 | 0.000 |
| Sb | | | | | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | | | | | |
| Sc | 0.005 | 0.009 | 0.011 | 0.010 | | | | 0.004 | 0.004 | 0.006 | 0.003 | 0.003 | 0.004 | 0.003 | 0.006 | 0.003 |
| Ca | 0.003 | 0.004 | 0.002 | 0.002 | 0.002 | 0.008 | 0.007 | 0.002 | 0.002 | 0.001 | 0.003 | 0.005 | 0.006 | 0.001 | 0.002 | 0.003 |
| Total | 3.009 | 3.001 | 3.009 | 3.016 | 3.023 | 3.023 | 3.019 | 3.018 | 3.007 | 3.017 | 3.010 | 3.012 | 3.020 | 3.004 | 3.019 | 3.026 |
| Mn/(Mn+Fe) | 0.621 | 0.727 | 0.572 | 0.648 | 0.624 | 0.793 | 0.814 | 0.705 | 0.636 | 0.698 | 0.836 | 0.692 | 0.692 | 0.767 | 0.758 | 0.778 |
| Ta/(Ta+Nb) | 0.259 | 0.216 | 0.223 | 0.214 | 0.269 | 0.338 | 0.291 | 0.275 | 0.262 | 0.273 | 0.301 | 0.259 | 0.286 | 0.274 | 0.280 | 0.304 |
| Comments: | incl. in | | | | | G & N acicular crystals | | | PH & PI | | | | PM & PN | | | |
| | garnet | | | | big crystal | | | | same grain | | | | same grain | | | |
| | | | | | appears to be two generations of manganocolumbite in this sample | | | | | | | | | | | |

| | Marko's pegmatite | | | | | | | | | | Marko's | Marko's | East Beryl pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44W | | | | | | | | | | 94-44Y | 94-44iii(V2) | 94-49 | | |
| | PR | PS | PU | PV | CH | CI | CJ | CK | CP | CT | UG | IB | WA | WB | WF |
| FeO | 3.94 | 3.51 | 4.22 | 3.94 | 6.54 | 5.88 | 3.09 | 3.04 | 4.19 | 6.66 | 10.32 | 1.84 | 13.03 | 13.06 | 12.84 |
| MnO | 13.70 | 14.09 | 13.79 | 13.87 | 11.24 | 11.99 | 12.86 | 12.75 | 13.45 | 11.18 | 7.42 | 13.48 | 5.01 | 5.01 | 5.32 |
| TiO2 | 2.75 | 2.11 | 2.81 | 2.78 | 3.10 | 2.68 | 0.92 | 0.90 | 2.28 | 2.58 | 2.20 | 1.64 | 2.75 | 2.75 | 2.45 |
| Nb2O5 | 44.40 | 46.17 | 45.03 | 45.49 | 47.45 | 47.58 | 24.46 | 22.56 | 44.80 | 47.04 | 39.42 | 22.79 | 59.53 | 59.87 | 52.87 |
| Ta2O5 | 32.24 | 32.23 | 32.20 | 32.03 | 27.80 | 27.90 | 56.86 | 59.41 | 31.59 | 29.60 | 37.06 | 57.72 | 15.42 | 15.31 | 23.83 |
| SnO2 | 0.66 | 0.41 | 0.78 | 0.67 | 0.68 | 0.62 | 0.31 | 0.27 | 0.63 | 0.61 | 0.73 | 1.24 | 0.04 | 0.03 | 0.00 |
| WO3 | 0.57 | 0.66 | 0.58 | 0.54 | 0.98 | 1.07 | 0.77 | 0.75 | 0.97 | 0.94 | 0.40 | 0.49 | 0.78 | 0.91 | 0.92 |
| PbO | 0.32 | 0.32 | 0.38 | 0.39 | 0.45 | 0.37 | 0.12 | 0.14 | 0.51 | 0.30 | 0.65 | 0.25 | 0.42 | 0.47 | 0.28 |
| ThO2 | 0.00 | 0.09 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.16 | 0.03 | 0.25 | 0.22 | 0.21 | 0.12 | 0.00 | 0.00 | 0.20 | 0.09 | 0.91 | 0.00 | 0.07 | 0.08 | 0.00 |
| Sb2O3 | | | | | | | | | | | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.07 | 0.07 | 0.03 | 0.15 | 0.11 | 0.05 | 0.09 | 0.13 | 0.11 | 0.03 | 0.06 | 0.30 | 0.37 | 0.07 |
| CaO | 0.07 | 0.05 | 0.03 | 0.05 | 0.01 | 0.01 | 0.00 | 0.02 | 0.03 | 0.00 | 0.10 | 0.19 | | | |
| Total | 98.84 | 99.74 | 100.16 | 100.04 | 98.61 | 98.33 | 99.44 | 99.91 | 98.76 | 99.10 | 99.34 | 99.70 | 97.36 | 97.85 | 98.57 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.214 | 0.189 | 0.226 | 0.211 | 0.349 | 0.316 | 0.189 | 0.187 | 0.228 | 0.356 | 0.578 | 0.112 | 0.666 | 0.664 | 0.673 |
| Mn | 0.754 | 0.768 | 0.748 | 0.752 | 0.608 | 0.652 | 0.796 | 0.795 | 0.742 | 0.606 | 0.421 | 0.834 | 0.259 | 0.258 | 0.282 |
| Ti | 0.134 | 0.102 | 0.135 | 0.134 | 0.149 | 0.130 | 0.050 | 0.050 | 0.111 | 0.124 | 0.111 | 0.090 | 0.126 | 0.126 | 0.115 |
| Nb | 1.304 | 1.343 | 1.304 | 1.317 | 1.370 | 1.380 | 0.808 | 0.750 | 1.319 | 1.362 | 1.193 | 0.753 | 1.644 | 1.645 | 1.498 |
| Ta | 0.569 | 0.564 | 0.561 | 0.558 | 0.483 | 0.487 | 1.130 | 1.189 | 0.560 | 0.515 | 0.675 | 1.147 | 0.256 | 0.253 | 0.406 |
| Sn | 0.017 | 0.011 | 0.020 | 0.017 | 0.017 | 0.016 | 0.009 | 0.008 | 0.016 | 0.016 | 0.019 | 0.036 | 0.001 | 0.001 | 0.000 |
| W | 0.010 | 0.011 | 0.010 | 0.009 | 0.016 | 0.018 | 0.015 | 0.014 | 0.016 | 0.016 | 0.007 | 0.009 | 0.012 | 0.014 | 0.015 |
| Pb | 0.006 | 0.006 | 0.007 | 0.007 | 0.008 | 0.006 | 0.002 | 0.003 | 0.009 | 0.005 | 0.012 | 0.005 | 0.007 | 0.008 | 0.005 |
| Th | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.000 | 0.004 | 0.003 | 0.003 | 0.002 | 0.000 | 0.000 | 0.003 | 0.001 | 0.014 | 0.000 | 0.001 | 0.001 | 0.000 |
| Sb | | | | | | | | | | | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | | | | | | | | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.004 | 0.004 | 0.002 | 0.008 | 0.006 | 0.003 | 0.005 | 0.007 | 0.006 | 0.002 | 0.004 | 0.016 | 0.019 | 0.004 |
| Ca | 0.005 | 0.003 | 0.002 | 0.003 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.007 | 0.015 | | | |
| Total | 3.016 | 3.002 | 3.021 | 3.014 | 3.014 | 3.013 | 3.003 | 3.002 | 3.015 | 3.008 | 3.039 | 3.005 | 2.989 | 2.988 | 2.997 |
| Mn/(Mn+Fe) | 0.779 | 0.803 | 0.768 | 0.781 | 0.635 | 0.674 | 0.808 | 0.810 | 0.765 | 0.630 | 0.421 | 0.881 | 0.280 | 0.280 | 0.296 |
| Ta/(Ta+Nb) | 0.304 | 0.296 | 0.301 | 0.298 | 0.261 | 0.261 | 0.583 | 0.613 | 0.298 | 0.275 | 0.361 | 0.604 | 0.135 | 0.133 | 0.213 |
| Comments: | PR & PS | | PU & PV | | CH - CK same grain | | | | | unzoned | | closely | WA & WB same grain | | |
| | same grain | | same grain | | early | early | later | later | | | | assoc. with | assoc. metamict Nb/U oxide | | |
| | | | | | | | rim | rim | | | | wodginite | | | |

**East Beryl pegmatite**

94-57

| | XA | XC | XD | XE | XG | XK | XO | XP | XQ | XR |
|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.20 | 13.82 | 13.56 | 14.03 | 14.90 | 14.98 | 10.93 | 12.85 | 11.10 | 10.63 |
| MnO | 4.35 | 4.06 | 4.18 | 3.60 | 3.97 | 3.78 | 6.48 | 4.36 | 6.20 | 6.49 |
| TiO2 | 0.04 | 0.52 | 0.07 | 0.78 | 1.61 | 0.88 | 0.12 | 0.08 | 0.09 | 0.05 |
| Nb2O5 | 42.10 | 45.27 | 42.43 | 42.71 | 56.48 | 54.93 | 38.67 | 36.10 | 37.85 | 36.50 |
| Ta2O5 | 39.08 | 34.84 | 39.22 | 37.30 | 20.79 | 23.42 | 43.91 | 45.94 | 44.37 | 46.43 |
| SnO2 | 0.11 | 0.10 | 0.09 | 0.10 | 0.17 | 0.07 | 0.04 | 0.13 | 0.06 | 0.07 |
| WO3 | 0.35 | 0.52 | 0.41 | 0.74 | 1.58 | 0.94 | 0.37 | 0.49 | 0.29 | 0.34 |
| PbO | 0.23 | 0.26 | 0.23 | 0.25 | 0.29 | 0.33 | 0.22 | 0.12 | 0.15 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.09 | 0.14 | 0.03 | 0.00 | 0.00 | 0.02 | 0.01 |
| CaO | | | | | | | | | | |
| Total | 99.48 | 99.39 | 100.19 | 99.60 | 99.92 | 99.37 | 100.73 | 100.06 | 100.11 | 100.65 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | |
| Fe | 0.741 | 0.760 | 0.755 | 0.779 | 0.764 | 0.783 | 0.618 | 0.740 | 0.633 | 0.609 |
| Mn | 0.248 | 0.226 | 0.236 | 0.202 | 0.206 | 0.200 | 0.371 | 0.254 | 0.358 | 0.376 |
| Ti | 0.002 | 0.026 | 0.004 | 0.039 | 0.074 | 0.041 | 0.006 | 0.004 | 0.005 | 0.002 |
| Nb | 1.278 | 1.347 | 1.278 | 1.281 | 1.566 | 1.553 | 1.182 | 1.124 | 1.167 | 1.130 |
| Ta | 0.714 | 0.624 | 0.711 | 0.673 | 0.347 | 0.398 | 0.807 | 0.861 | 0.823 | 0.864 |
| Sn | 0.003 | 0.003 | 0.002 | 0.003 | 0.004 | 0.002 | 0.001 | 0.004 | 0.002 | 0.002 |
| W | 0.006 | 0.009 | 0.007 | 0.013 | 0.025 | 0.015 | 0.006 | 0.009 | 0.005 | 0.006 |
| Pb | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.006 | 0.004 | 0.002 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.005 | 0.008 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 |
| Ca | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.996 | 2.999 | 2.997 | 2.999 | 2.999 | 3.000 | 2.996 | 2.998 | 2.997 | 2.992 |
| Mn/(Mn+Fe) | 0.250 | 0.229 | 0.238 | 0.206 | 0.212 | 0.204 | 0.375 | 0.256 | 0.361 | 0.382 |
| Ta/(Ta+Nb) | 0.358 | 0.316 | 0.357 | 0.344 | 0.181 | 0.204 | 0.406 | 0.434 | 0.414 | 0.433 |

Comments: XA, XC & XD same grain XP- XR same grain - all primary comps.
XC replacement comp. XE primary composition
rest are patchy zoned secondary/replacement comps.

| | **Pegmatite 5** | | | | | | **Treelined Lake Complex** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-80i | | | | | | 94-84A | | | | | | | | |
| | QK | QL | QM | QN | QO | QT | AA | YA | YB | YC | YD | YE | YF | YG | YH |
| FeO | 10.62 | 10.65 | 10.49 | 10.31 | 10.75 | 9.61 | 6.48 | 6.19 | 6.05 | 5.66 | 5.46 | 5.87 | 5.36 | 5.62 | 5.64 |
| MnO | 5.18 | 5.15 | 5.23 | 5.58 | 5.21 | 6.28 | 11.18 | 12.00 | 12.55 | 11.72 | 11.94 | 11.46 | 11.39 | 10.10 | 10.55 |
| TiO2 | 1.44 | 1.43 | 1.47 | 1.36 | 1.36 | 1.36 | 0.25 | 0.62 | 0.53 | 0.23 | 0.24 | 0.22 | 0.18 | 0.92 | 1.07 |
| Nb2O5 | 26.25 | 27.22 | 26.98 | 27.68 | 27.93 | 27.79 | 37.47 | 46.53 | 49.03 | 35.56 | 37.48 | 38.25 | 34.42 | 27.24 | 29.67 |
| Ta2O5 | 54.20 | 53.58 | 54.14 | 53.63 | 53.87 | 53.97 | 40.61 | 30.28 | 28.26 | 42.93 | 43.01 | 41.10 | 48.29 | 52.01 | 50.22 |
| SnO2 | 0.34 | 0.35 | 0.41 | 0.33 | 0.32 | 0.30 | 0.08 | 0.22 | 0.12 | 0.07 | 0.10 | 0.07 | 0.06 | 0.33 | 0.37 |
| WO3 | 1.25 | 0.71 | 0.54 | 0.55 | 0.58 | 0.55 | 3.55 | 3.32 | 3.24 | 3.01 | 1.86 | 1.97 | 1.28 | 2.49 | 2.53 |
| PbO | 0.11 | 0.10 | 0.13 | 0.13 | 0.13 | 0.14 | 0.17 | 0.21 | 0.28 | 0.19 | 0.24 | 0.15 | 0.17 | 0.09 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.34 | 0.36 | 0.66 | 0.34 | 0.52 | 0.36 | 0.04 | 0.10 | 0.06 | 0.14 | 0.06 | 0.05 | 0.00 | 0.36 | 0.00 |
| CaO | | | | | | | | | | | | | | | |
| Total | 99.74 | 99.54 | 100.07 | 99.91 | 100.64 | 100.37 | 99.82 | 99.46 | 100.13 | 99.49 | 100.39 | 99.15 | 101.15 | 99.56 | 100.13 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.637 | 0.637 | 0.624 | 0.614 | 0.634 | 0.570 | 0.369 | 0.336 | 0.323 | 0.326 | 0.310 | 0.335 | 0.308 | 0.337 | 0.332 |
| Mn | 0.314 | 0.312 | 0.315 | 0.336 | 0.311 | 0.377 | 0.644 | 0.660 | 0.679 | 0.684 | 0.687 | 0.663 | 0.664 | 0.614 | 0.629 |
| Ti | 0.078 | 0.077 | 0.079 | 0.073 | 0.072 | 0.073 | 0.013 | 0.030 | 0.025 | 0.012 | 0.012 | 0.011 | 0.009 | 0.050 | 0.057 |
| Nb | 0.851 | 0.880 | 0.867 | 0.891 | 0.891 | 0.890 | 1.153 | 1.366 | 1.416 | 1.109 | 1.151 | 1.181 | 1.070 | 0.883 | 0.944 |
| Ta | 1.057 | 1.042 | 1.047 | 1.038 | 1.034 | 1.040 | 0.752 | 0.535 | 0.491 | 0.805 | 0.795 | 0.764 | 0.903 | 1.014 | 0.961 |
| Sn | 0.010 | 0.010 | 0.011 | 0.009 | 0.009 | 0.009 | 0.002 | 0.006 | 0.003 | 0.002 | 0.003 | 0.002 | 0.002 | 0.009 | 0.010 |
| W | 0.023 | 0.013 | 0.010 | 0.010 | 0.011 | 0.010 | 0.063 | 0.056 | 0.054 | 0.054 | 0.033 | 0.035 | 0.023 | 0.046 | 0.046 |
| Pb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 | 0.002 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.021 | 0.022 | 0.041 | 0.021 | 0.032 | 0.022 | 0.002 | 0.006 | 0.003 | 0.009 | 0.003 | 0.003 | 0.000 | 0.023 | 0.000 |
| Ca | | | | | | | | | | | | | | | |
| Total | 2.994 | 2.994 | 2.998 | 2.994 | 2.995 | 2.993 | 3.001 | 2.998 | 3.001 | 3.004 | 2.999 | 2.998 | 2.983 | 2.985 | 2.982 |
| Mn/(Mn+Fe | 0.331 | 0.329 | 0.336 | 0.354 | 0.329 | 0.398 | 0.636 | 0.663 | 0.678 | 0.677 | 0.689 | 0.664 | 0.683 | 0.645 | 0.655 |
| Ta/(Ta+Nb) | 0.554 | 0.542 | 0.547 | 0.538 | 0.537 | 0.539 | 0.395 | 0.281 | 0.257 | 0.421 | 0.408 | 0.393 | 0.458 | 0.535 | 0.504 |
| Comments: | QL - QT same grain | | | | | | | | YA - YD | | | | | YE - YT | |
| | QK is nearby QL - QT & is assoc. | | | | | | | | same grain | | | | | same grain | |
| | with earlier crystallized cassiterite | | | | | | from miarolitic cavity | | | core | | | | | |

**Treelined Lake Complex**

94-84A

| | YI | YJ | YK | YL | YM | YN | YO | YP | YQ | YR | YS | YT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 6.28 | 6.25 | 6.52 | 6.46 | 6.41 | 6.47 | 6.50 | 6.31 | 6.24 | 6.24 | 6.21 | 5.41 |
| MnO | 11.13 | 10.91 | 11.89 | 11.73 | 11.69 | 11.51 | 11.52 | 11.08 | 11.08 | 12.09 | 10.85 | 10.93 |
| TiO2 | 0.74 | 0.68 | 0.44 | 0.55 | 0.59 | 0.62 | 0.59 | 0.89 | 0.89 | 0.51 | 0.24 | 0.92 |
| Nb2O5 | 36.19 | 37.66 | 47.49 | 47.01 | 47.24 | 46.29 | 46.17 | 38.32 | 38.16 | 50.50 | 37.30 | 30.63 |
| Ta2O5 | 40.31 | 40.57 | 28.53 | 30.61 | 31.41 | 31.67 | 31.94 | 39.45 | 40.11 | 28.03 | 42.99 | 50.91 |
| SnO2 | 0.22 | 0.16 | 0.10 | 0.21 | 0.16 | 0.21 | 0.20 | 0.31 | 0.25 | 0.10 | 0.11 | 0.22 |
| WO3 | 5.69 | 4.06 | 5.32 | 3.85 | 3.04 | 3.63 | 3.63 | 3.66 | 3.52 | 2.89 | 2.59 | 1.62 |
| PbO | 0.17 | 0.16 | 0.22 | 0.27 | 0.22 | 0.20 | 0.21 | 0.17 | 0.19 | 0.23 | 0.20 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.15 | 0.02 | 0.03 | 0.14 | 0.02 | 0.11 | 0.15 | 0.14 | 0.10 | 0.01 | 0.01 |
| CaO | | | | | | | | | | | | |
| Total | 100.87 | 100.62 | 100.52 | 100.71 | 100.89 | 100.61 | 100.85 | 100.35 | 100.56 | 100.70 | 100.50 | 100.80 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.355 | 0.352 | 0.350 | 0.347 | 0.344 | 0.349 | 0.350 | 0.354 | 0.350 | 0.330 | 0.353 | 0.316 |
| Mn | 0.636 | 0.622 | 0.646 | 0.638 | 0.634 | 0.629 | 0.628 | 0.630 | 0.629 | 0.648 | 0.625 | 0.647 |
| Ti | 0.037 | 0.035 | 0.021 | 0.027 | 0.028 | 0.030 | 0.029 | 0.045 | 0.045 | 0.024 | 0.012 | 0.048 |
| Nb | 1.104 | 1.146 | 1.377 | 1.366 | 1.369 | 1.350 | 1.344 | 1.162 | 1.157 | 1.444 | 1.146 | 0.967 |
| Ta | 0.740 | 0.742 | 0.498 | 0.535 | 0.547 | 0.556 | 0.559 | 0.719 | 0.731 | 0.482 | 0.794 | 0.967 |
| Sn | 0.006 | 0.004 | 0.003 | 0.005 | 0.004 | 0.005 | 0.005 | 0.008 | 0.007 | 0.002 | 0.003 | 0.006 |
| W | 0.099 | 0.071 | 0.088 | 0.064 | 0.050 | 0.061 | 0.061 | 0.064 | 0.061 | 0.047 | 0.046 | 0.029 |
| Pb | 0.003 | 0.003 | 0.004 | 0.005 | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 | 0.004 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.007 | 0.009 | 0.001 | 0.002 | 0.008 | 0.001 | 0.006 | 0.009 | 0.008 | 0.005 | 0.000 | 0.000 |
| Ca | | | | | | | | | | | | |
| Total | 2.988 | 2.983 | 2.987 | 2.988 | 2.989 | 2.984 | 2.986 | 2.993 | 2.990 | 2.987 | 2.983 | 2.985 |
| Mn/(Mn+Fe | 0.642 | 0.639 | 0.649 | 0.648 | 0.649 | 0.643 | 0.642 | 0.640 | 0.643 | 0.663 | 0.639 | 0.672 |
| Ta/(Ta+Nb) | 0.401 | 0.393 | 0.265 | 0.281 | 0.286 | 0.292 | 0.294 | 0.382 | 0.387 | 0.250 | 0.409 | 0.500 |

Comments: YI - YQ traverse along grain
banded zonation unlike any
seen in Separation Rapids pegmatites

| | **East Beryl pegmatite** | | | | **East Beryl pegmatite** | | | | | | | **E Beryl peg.** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-304 | | | | 94-304A | | | | | | | 94-304C | |
| | NC | ND | NE | NF | EA | EB | EE | EF | EK | EL | EN | KA | KG |
| FeO | 5.46 | 4.91 | 7.17 | 5.38 | 5.20 | 4.31 | 5.27 | 5.48 | 7.24 | 6.68 | 6.63 | 13.48 | 12.89 |
| MnO | 14.65 | 14.86 | 14.33 | 14.54 | 11.60 | 12.66 | 11.65 | 11.45 | 11.26 | 12.25 | 11.57 | 4.17 | 3.87 |
| TiO2 | 2.87 | 1.98 | 1.76 | 2.77 | 1.40 | 1.69 | 1.52 | 1.49 | 2.45 | 1.94 | 1.50 | 0.55 | 0.70 |
| Nb2O5 | 61.63 | 63.65 | 63.54 | 63.51 | 43.22 | 42.35 | 43.71 | 44.83 | 61.77 | 63.95 | 55.14 | 45.51 | 29.22 |
| Ta2O5 | 12.12 | 12.53 | 12.47 | 11.46 | 35.88 | 36.11 | 34.49 | 34.32 | 11.99 | 11.34 | 21.89 | 34.54 | 50.57 |
| SnO2 | 0.51 | 0.18 | 0.14 | 0.48 | 0.12 | 0.20 | 0.22 | 0.14 | 0.42 | 0.40 | 0.49 | 0.49 | 1.10 |
| WO3 | 0.53 | 0.68 | 0.42 | 0.76 | 0.44 | 1.16 | 1.13 | 0.93 | 1.36 | 1.21 | 0.49 | 0.74 | 0.08 |
| PbO | 0.64 | 0.62 | 0.43 | 0.51 | 0.15 | 0.07 | 0.65 | 0.29 | 0.53 | 0.28 | 0.20 | 0.43 | 0.53 |
| ThO2 | 0.03 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 1.47 | 0.73 | 0.08 | 0.21 | 0.00 | 0.00 | 0.56 | 0.00 | 0.65 | 0.00 | 0.04 | 0.25 | 0.00 |
| Sb2O3 | | | | | 0.14 | 0.00 | 0.00 | 0.11 | 0.09 | 0.10 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | | | | | 0.00 | 0.00 | 0.40 | 0.09 | 0.04 | 0.38 | 0.00 | 0.51 | 0.42 |
| Sc2O3 | 0.00 | 0.02 | 0.03 | 0.02 | 0.31 | 0.00 | 0.10 | 1.39 | 1.02 | 0.00 | 0.32 | 0.00 | 0.11 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | | | | |
| Total | 99.91 | 100.18 | 100.34 | 99.62 | 98.44 | 98.55 | 99.69 | 100.51 | 98.81 | 98.53 | 98.29 | 100.66 | 99.51 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.272 | 0.243 | 0.354 | 0.265 | 0.288 | 0.240 | 0.290 | 0.295 | 0.362 | 0.334 | 0.346 | 0.736 | 0.771 |
| Mn | 0.738 | 0.745 | 0.716 | 0.726 | 0.651 | 0.712 | 0.649 | 0.623 | 0.570 | 0.620 | 0.612 | 0.231 | 0.234 |
| Ti | 0.128 | 0.088 | 0.078 | 0.123 | 0.070 | 0.085 | 0.075 | 0.072 | 0.110 | 0.087 | 0.071 | 0.027 | 0.038 |
| Nb | 1.658 | 1.704 | 1.695 | 1.693 | 1.296 | 1.271 | 1.300 | 1.303 | 1.668 | 1.727 | 1.557 | 1.343 | 0.945 |
| Ta | 0.196 | 0.202 | 0.200 | 0.184 | 0.647 | 0.652 | 0.617 | 0.600 | 0.195 | 0.184 | 0.372 | 0.613 | 0.983 |
| Sn | 0.012 | 0.004 | 0.003 | 0.011 | 0.003 | 0.005 | 0.006 | 0.004 | 0.010 | 0.009 | 0.012 | 0.013 | 0.031 |
| W | 0.008 | 0.010 | 0.006 | 0.012 | 0.008 | 0.020 | 0.019 | 0.015 | 0.021 | 0.019 | 0.008 | 0.012 | 0.002 |
| Pb | 0.010 | 0.010 | 0.007 | 0.008 | 0.003 | 0.001 | 0.012 | 0.005 | 0.008 | 0.005 | 0.003 | 0.007 | 0.010 |
| Th | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.019 | 0.010 | 0.001 | 0.003 | 0.000 | 0.000 | 0.008 | 0.000 | 0.009 | 0.000 | 0.001 | 0.004 | 0.000 |
| Sb | | | | | 0.004 | 0.000 | 0.000 | 0.003 | 0.002 | 0.003 | 0.001 | 0.000 | 0.000 |
| Bi | | | | | 0.000 | 0.000 | 0.007 | 0.001 | 0.001 | 0.006 | 0.000 | 0.009 | 0.008 |
| Sc | 0.000 | 0.001 | 0.002 | 0.001 | 0.018 | 0.000 | 0.006 | 0.078 | 0.053 | 0.000 | 0.017 | 0.000 | 0.007 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.043 | 3.019 | 3.063 | 3.026 | 2.987 | 2.986 | 2.990 | 2.999 | 3.008 | 2.994 | 2.999 | 2.994 | 3.029 |
| Mn/(Mn+Fe | 0.731 | 0.754 | 0.669 | 0.732 | 0.693 | 0.748 | 0.691 | 0.679 | 0.612 | 0.650 | 0.639 | 0.239 | 0.233 |
| Ta/(Ta+Nb) | 0.106 | 0.106 | 0.106 | 0.098 | 0.333 | 0.339 | 0.322 | 0.315 | 0.105 | 0.096 | 0.193 | 0.313 | 0.510 |
| Comments: | NC & ND<br>same grain | | NE & NF<br>same grain | | EA - EF same grain<br>assoc. with zircon<br>radiating texture | | | | EK - EN<br>same grain<br>core | core | rim | incls. in cass. | |

**Pegmatite 9**

94-318

| | VG | VH | VS | VU | VV | BB | BC1 | BC2 | BC3 | BC4 | BC5 | BC6 | BC7 | BC8 | BC9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 14.65 | 14.91 | 13.90 | 15.03 | 14.33 | 14.63 | 15.70 | 14.82 | 14.80 | 14.59 | 14.85 | 15.89 | 16.01 | 16.04 | 16.02 |
| MnO | 2.42 | 2.43 | 2.11 | 2.37 | 2.46 | 1.74 | 1.87 | 1.81 | 1.75 | 1.76 | 1.76 | 1.86 | 1.91 | 1.88 | 1.88 |
| TiO2 | 1.32 | 1.24 | 0.87 | 1.12 | 0.99 | 0.92 | 1.03 | 0.88 | 0.83 | 0.94 | 0.90 | 1.04 | 1.11 | 1.08 | 1.08 |
| Nb2O5 | 29.07 | 33.34 | 21.02 | 29.62 | 31.37 | 26.34 | 39.87 | 27.34 | 26.14 | 26.05 | 26.71 | 39.72 | 40.18 | 39.60 | 39.55 |
| Ta2O5 | 49.60 | 46.49 | 61.09 | 50.01 | 49.62 | 53.32 | 39.03 | 52.35 | 54.15 | 53.46 | 53.68 | 38.80 | 37.77 | 38.30 | 38.66 |
| SnO2 | 0.33 | 0.33 | 0.44 | 0.28 | 0.33 | 0.17 | 0.16 | 0.20 | 0.16 | 0.19 | 0.22 | 0.21 | 0.21 | 0.18 | 0.20 |
| WO3 | 0.78 | 0.94 | 0.24 | 0.78 | 0.68 | 1.86 | 1.63 | 1.77 | 1.82 | 1.86 | 1.86 | 2.30 | 2.55 | 2.35 | 2.40 |
| PbO | 0.31 | 0.28 | 0.18 | 0.11 | 0.32 | 0.09 | 0.17 | 0.09 | 0.12 | 0.08 | 0.16 | 0.24 | 0.20 | 0.18 | 0.20 |
| ThO2 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.14 | 0.13 | 0.13 | 0.05 | 0.11 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.07 | 0.01 |
| Sb2O3 | 0.08 | 0.06 | 0.06 | 0.06 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.07 | 0.05 | 0.05 | 0.05 | 0.00 | 0.04 | 0.17 | 0.01 | 0.00 | 0.01 | 0.06 | 0.03 | 0.07 | 0.01 |
| CaO | 0.15 | 0.15 | 0.00 | 0.07 | 0.00 | 0.10 | 0.00 | 0.01 | 0.00 | 0.11 | 0.02 | 0.00 | 0.00 | 0.02 | 0.02 |
| Total | 98.93 | 100.38 | 100.11 | 99.56 | 100.36 | 99.18 | 99.52 | 99.44 | 99.78 | 99.04 | 100.20 | 100.18 | 99.97 | 99.78 | 100.03 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.873 | 0.859 | 0.864 | 0.889 | 0.838 | 0.886 | 0.882 | 0.890 | 0.894 | 0.886 | 0.891 | 0.887 | 0.893 | 0.898 | 0.896 |
| Mn | 0.146 | 0.142 | 0.133 | 0.142 | 0.146 | 0.107 | 0.107 | 0.110 | 0.107 | 0.108 | 0.107 | 0.105 | 0.108 | 0.107 | 0.107 |
| Ti | 0.071 | 0.064 | 0.049 | 0.060 | 0.052 | 0.050 | 0.052 | 0.048 | 0.045 | 0.051 | 0.049 | 0.052 | 0.055 | 0.054 | 0.054 |
| Nb | 0.937 | 1.038 | 0.706 | 0.947 | 0.992 | 0.863 | 1.210 | 0.888 | 0.854 | 0.855 | 0.866 | 1.199 | 1.211 | 1.199 | 1.196 |
| Ta | 0.961 | 0.871 | 1.234 | 0.962 | 0.944 | 1.050 | 0.713 | 1.023 | 1.064 | 1.056 | 1.047 | 0.705 | 0.685 | 0.698 | 0.703 |
| Sn | 0.009 | 0.009 | 0.013 | 0.008 | 0.009 | 0.005 | 0.004 | 0.006 | 0.005 | 0.005 | 0.006 | 0.006 | 0.006 | 0.005 | 0.005 |
| W | 0.014 | 0.017 | 0.005 | 0.014 | 0.012 | 0.035 | 0.028 | 0.033 | 0.034 | 0.035 | 0.035 | 0.040 | 0.044 | 0.041 | 0.042 |
| Pb | 0.006 | 0.005 | 0.004 | 0.002 | 0.006 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 | 0.004 | 0.004 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.004 | 0.003 | 0.003 | 0.003 | 0.000 | 0.003 | 0.010 | 0.001 | 0.000 | 0.001 | 0.003 | 0.002 | 0.004 | 0.000 |
| Ca | 0.011 | 0.011 | 0.000 | 0.005 | 0.000 | 0.008 | 0.000 | 0.001 | 0.000 | 0.008 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
| Total | 3.038 | 3.024 | 3.014 | 3.036 | 3.006 | 3.006 | 3.001 | 3.010 | 3.005 | 3.007 | 3.006 | 3.003 | 3.007 | 3.011 | 3.008 |
| Mn/(Mn+Fe | 0.143 | 0.142 | 0.133 | 0.138 | 0.148 | 0.108 | 0.108 | 0.110 | 0.107 | 0.109 | 0.107 | 0.106 | 0.108 | 0.106 | 0.106 |
| Ta/(Ta+Nb) | 0.507 | 0.456 | 0.636 | 0.504 | 0.488 | 0.549 | 0.371 | 0.535 | 0.555 | 0.552 | 0.547 | 0.370 | 0.361 | 0.368 | 0.370 |

Comments: VG & VH
same grain
associated with large cassiterite grains

BB & BC3 very close together
core
BC traverse 128 µm has a Sn-W rich rim - ixiolite?

| | Pegmatite 9 | | | | | | | | | | | Near Lou's pegmatite | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-318 | | | | | | | | | | | 94-355 | | | |
| | BC10 | BC11 | BC12 | BC13 | BC14 | BC15 | BC16 | BH | BD | BE | BG | SA | SB | SC | SD |
| FeO | 15.93 | 15.74 | 15.58 | 15.94 | 15.93 | 15.91 | 16.26 | 15.15 | 15.73 | 14.29 | 14.30 | 17.90 | 17.79 | 17.80 | 17.46 |
| MnO | 1.92 | 1.85 | 1.82 | 1.87 | 1.88 | 1.96 | 1.95 | 1.84 | 1.87 | 2.11 | 2.11 | 2.24 | 2.34 | 2.35 | 2.67 |
| TiO2 | 1.05 | 1.05 | 1.25 | 1.35 | 1.21 | 1.15 | 1.19 | 1.78 | 1.25 | 1.03 | 0.94 | 0.73 | 0.70 | 0.73 | 0.74 |
| Nb2O5 | 39.18 | 38.81 | 37.96 | 40.86 | 41.33 | 43.83 | 45.58 | 33.16 | 37.91 | 24.65 | 26.28 | 71.17 | 70.39 | 71.19 | 70.66 |
| Ta2O5 | 38.86 | 40.97 | 41.43 | 38.43 | 37.10 | 34.75 | 32.95 | 45.36 | 41.13 | 56.50 | 54.60 | 6.35 | 6.39 | 6.46 | 6.38 |
| SnO2 | 0.18 | 0.21 | 0.42 | 0.38 | 0.36 | 0.27 | 0.19 | 0.31 | 0.17 | 0.31 | 0.30 | 0.01 | 0.00 | 0.03 | 0.00 |
| WO3 | 2.40 | 1.53 | 1.14 | 1.29 | 1.16 | 1.24 | 1.36 | 2.12 | 2.00 | 1.11 | 1.16 | 0.48 | 0.38 | 0.52 | 0.57 |
| PbO | 0.23 | 0.24 | 0.20 | 0.16 | 0.18 | 0.29 | 0.24 | 0.18 | 0.14 | 0.04 | 0.12 | 0.37 | 0.34 | 0.38 | 0.35 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.07 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.04 | 0.00 | 0.04 | 0.21 | 0.00 | 0.08 | 0.00 | 0.10 | 0.20 | 0.05 | 0.22 | 0.22 | 0.34 | 0.18 |
| CaO | 0.02 | 0.04 | 0.01 | 0.00 | 0.04 | 0.04 | 0.01 | 0.04 | 0.03 | 0.00 | 0.00 | | | | |
| Total | 99.96 | 100.52 | 99.80 | 100.33 | 99.41 | 99.45 | 99.82 | 99.98 | 100.35 | 100.24 | 99.86 | 99.48 | 98.55 | 99.79 | 99.01 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.893 | 0.882 | 0.880 | 0.882 | 0.886 | 0.876 | 0.883 | 0.871 | 0.884 | 0.865 | 0.862 | 0.868 | 0.871 | 0.860 | 0.851 |
| Mn | 0.109 | 0.105 | 0.104 | 0.105 | 0.106 | 0.109 | 0.107 | 0.107 | 0.107 | 0.129 | 0.129 | 0.110 | 0.116 | 0.115 | 0.132 |
| Ti | 0.053 | 0.053 | 0.064 | 0.067 | 0.061 | 0.057 | 0.058 | 0.092 | 0.063 | 0.056 | 0.051 | 0.032 | 0.031 | 0.032 | 0.033 |
| Nb | 1.187 | 1.175 | 1.159 | 1.222 | 1.243 | 1.304 | 1.339 | 1.031 | 1.151 | 0.806 | 0.857 | 1.865 | 1.863 | 1.861 | 1.862 |
| Ta | 0.708 | 0.746 | 0.761 | 0.692 | 0.671 | 0.622 | 0.582 | 0.848 | 0.751 | 1.112 | 1.070 | 0.100 | 0.102 | 0.102 | 0.101 |
| Sn | 0.005 | 0.006 | 0.011 | 0.010 | 0.010 | 0.007 | 0.005 | 0.009 | 0.005 | 0.009 | 0.009 | 0.000 | 0.000 | 0.001 | 0.000 |
| W | 0.042 | 0.027 | 0.020 | 0.022 | 0.020 | 0.021 | 0.023 | 0.038 | 0.035 | 0.021 | 0.022 | 0.007 | 0.006 | 0.008 | 0.009 |
| Pb | 0.004 | 0.004 | 0.004 | 0.003 | 0.003 | 0.005 | 0.004 | 0.003 | 0.003 | 0.001 | 0.002 | 0.006 | 0.005 | 0.006 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.008 | 0.002 | 0.000 | 0.002 | 0.012 | 0.000 | 0.005 | 0.000 | 0.006 | 0.012 | 0.003 | 0.011 | 0.011 | 0.017 | 0.009 |
| Ca | 0.001 | 0.003 | 0.001 | 0.000 | 0.003 | 0.003 | 0.001 | 0.003 | 0.002 | 0.000 | 0.000 | | | | |
| Total | 3.011 | 3.004 | 3.004 | 3.006 | 3.014 | 3.004 | 3.007 | 3.003 | 3.006 | 3.010 | 3.005 | 3.000 | 3.005 | 3.001 | 3.001 |
| Mn/(Mn+Fe | 0.109 | 0.107 | 0.106 | 0.106 | 0.107 | 0.111 | 0.108 | 0.109 | 0.108 | 0.130 | 0.130 | 0.113 | 0.118 | 0.118 | 0.134 |
| Ta/(Ta+Nb) | 0.374 | 0.388 | 0.396 | 0.361 | 0.351 | 0.323 | 0.303 | 0.451 | 0.395 | 0.580 | 0.555 | 0.051 | 0.052 | 0.052 | 0.052 |
| Comments: | | | | | | | rim | | | | | SA & SB<br>same grain<br>quartz-rich dyke in petalite zone | | SC & SD<br>same grain | |

## Pegmatite 7

### 94-Peg 7B

| | QG | WA | PC | PF | PG3 | PG4 | PG5 | PG6 | PG8 | PD | PG1 | PG9 | PG10 | WR | WS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.73 | 10.35 | 9.64 | 9.12 | 8.99 | 9.54 | 9.02 | 8.30 | 9.43 | 9.20 | 9.30 | 7.43 | 8.39 | 12.96 | 13.04 |
| MnO | 6.32 | 5.74 | 6.27 | 6.10 | 6.18 | 6.69 | 6.38 | 6.13 | 6.61 | 7.59 | 7.36 | 6.15 | 7.73 | 3.19 | 3.23 |
| TiO2 | 1.16 | 1.09 | 0.92 | 0.97 | 0.96 | 1.02 | 0.99 | 1.04 | 1.02 | 0.75 | 0.84 | 1.03 | 0.82 | 2.81 | 2.79 |
| Nb2O5 | 26.85 | 23.77 | 27.54 | 26.19 | 25.26 | 24.30 | 24.12 | 25.31 | 26.72 | 38.23 | 35.48 | 31.32 | 41.29 | 26.99 | 28.10 |
| Ta2O5 | 53.62 | 52.97 | 52.68 | 53.55 | 53.53 | 53.46 | 54.20 | 54.34 | 53.38 | 41.77 | 44.99 | 48.15 | 39.29 | 50.43 | 49.26 |
| SnO2 | 1.13 | 2.29 | 0.89 | 1.16 | 1.13 | 1.46 | 2.00 | 0.75 | 0.64 | 0.24 | 0.28 | 0.92 | 0.22 | 1.86 | 1.97 |
| WO3 | 0.94 | 2.15 | 1.39 | 1.86 | 1.61 | 1.74 | 2.05 | 1.32 | 1.63 | 0.85 | 0.91 | 1.31 | 1.17 | 0.01 | 0.17 |
| PbO | 0.15 | 0.15 | 0.13 | 0.15 | 0.25 | 0.13 | 0.08 | 0.05 | 0.12 | 0.35 | 0.18 | 0.19 | 0.20 | 0.27 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.14 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.08 | 0.17 |
| Sb2O3 | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.06 |
| Bi2O3 | | | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | | |
| Sc2O3 | | 0.24 | 0.29 | 0.34 | 0.27 | 0.24 | 0.28 | 0.31 | 0.05 | 0.46 | 0.58 | 0.50 | 0.48 | 0.80 | 0.78 |
| CaO | 1.56 | 0.38 | 0.25 | 0.72 | 1.38 | 0.67 | 0.67 | 1.91 | 0.11 | 0.21 | 0.10 | 2.13 | 0.72 | 0.08 | 0.09 |
| Total | 100.46 | 99.27 | 100.01 | 100.15 | 99.59 | 99.24 | 99.79 | 99.46 | 99.73 | 99.64 | 100.03 | 99.21 | 100.30 | 99.53 | 99.85 |

**Structural formulae based on 6 oxygens**

| | QG | WA | PC | PF | PG3 | PG4 | PG5 | PG6 | PG8 | PD | PG1 | PG9 | PG10 | WR | WS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.518 | 0.631 | 0.574 | 0.545 | 0.542 | 0.580 | 0.547 | 0.500 | 0.566 | 0.521 | 0.532 | 0.434 | 0.464 | 0.762 | 0.760 |
| Mn | 0.380 | 0.354 | 0.379 | 0.369 | 0.377 | 0.412 | 0.391 | 0.374 | 0.402 | 0.435 | 0.426 | 0.364 | 0.433 | 0.190 | 0.191 |
| Ti | 0.062 | 0.060 | 0.049 | 0.052 | 0.052 | 0.056 | 0.054 | 0.056 | 0.055 | 0.038 | 0.043 | 0.054 | 0.041 | 0.149 | 0.146 |
| Nb | 0.861 | 0.783 | 0.887 | 0.847 | 0.824 | 0.798 | 0.790 | 0.824 | 0.868 | 1.170 | 1.096 | 0.989 | 1.235 | 0.858 | 0.886 |
| Ta | 1.035 | 1.049 | 1.021 | 1.042 | 1.050 | 1.057 | 1.068 | 1.064 | 1.043 | 0.769 | 0.836 | 0.915 | 0.707 | 0.964 | 0.934 |
| Sn | 0.032 | 0.067 | 0.025 | 0.033 | 0.033 | 0.042 | 0.058 | 0.021 | 0.018 | 0.006 | 0.008 | 0.026 | 0.006 | 0.052 | 0.055 |
| W | 0.017 | 0.041 | 0.026 | 0.034 | 0.030 | 0.033 | 0.039 | 0.025 | 0.030 | 0.015 | 0.016 | 0.024 | 0.020 | 0.000 | 0.003 |
| Pb | 0.003 | 0.003 | 0.003 | 0.003 | 0.005 | 0.003 | 0.002 | 0.001 | 0.002 | 0.006 | 0.003 | 0.004 | 0.004 | 0.005 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.003 |
| Sb | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 |
| Bi | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | |
| Sc | | 0.015 | 0.018 | 0.021 | 0.017 | 0.015 | 0.017 | 0.019 | 0.003 | 0.027 | 0.034 | 0.031 | 0.028 | 0.049 | 0.047 |
| Ca | 0.119 | 0.030 | 0.019 | 0.055 | 0.106 | 0.052 | 0.052 | 0.147 | 0.008 | 0.015 | 0.007 | 0.159 | 0.051 | 0.006 | 0.007 |
| Total | 3.027 | 3.034 | 3.002 | 3.002 | 3.036 | 3.047 | 3.016 | 3.031 | 2.998 | 3.003 | 3.002 | 3.000 | 2.987 | 3.039 | 3.036 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe | 0.423 | 0.360 | 0.397 | 0.404 | 0.411 | 0.415 | 0.417 | 0.428 | 0.415 | 0.455 | 0.445 | 0.456 | 0.483 | 0.200 | 0.201 |
| Ta/(Ta+Nb) | 0.546 | 0.573 | 0.535 | 0.552 | 0.560 | 0.570 | 0.575 | 0.564 | 0.546 | 0.397 | 0.433 | 0.480 | 0.364 | 0.529 | 0.513 |
| Comments: | | cassiterite-rich sample | | | | PG traverse across 145 µm<br>patchy euhedral crystal | | | | PD - PG10 euhedral crystals<br>with patchy replacement | | | | WR & WS incls.<br>in cassiterite | |

| | **Pegmatite 7** | | | | **Pegmatite 8** | | | **Pegmatite 11** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-Peg 7X | | | | 94-Peg 8A | | | 95-117A | | | | | |
| | LR | LS | LT | LU | CC | CD | CE | VE | VF | VG | VH | VI | VJ |
| FeO | 9.61 | 5.49 | 6.66 | 7.30 | 13.26 | 13.77 | 13.19 | 11.17 | 9.47 | 9.70 | 9.85 | 9.90 | 9.45 |
| MnO | 7.22 | 4.66 | 4.90 | 5.41 | 5.46 | 5.58 | 5.68 | 6.15 | 5.90 | 6.01 | 5.83 | 5.82 | 5.79 |
| TiO2 | 0.85 | 1.14 | 1.24 | 1.06 | 0.53 | 0.40 | 0.63 | 3.04 | 0.74 | 0.73 | 1.52 | 1.24 | 0.58 |
| Nb2O5 | 34.40 | 27.89 | 27.40 | 24.57 | 52.74 | 60.63 | 54.43 | 45.64 | 21.08 | 25.28 | 23.59 | 26.81 | 19.13 |
| Ta2O5 | 44.96 | 48.00 | 48.76 | 53.49 | 26.18 | 17.69 | 23.37 | 31.34 | 61.22 | 57.62 | 57.61 | 53.43 | 65.25 |
| SnO2 | 0.58 | 2.07 | 1.03 | 1.52 | 0.16 | 0.08 | 0.23 | 0.86 | 0.23 | 0.16 | 0.31 | 0.30 | 0.21 |
| WO3 | 2.17 | 1.32 | 3.09 | 2.49 | 0.85 | 1.49 | 1.26 | 1.40 | 1.21 | 0.88 | 1.53 | 1.01 | 0.66 |
| PbO | 0.18 | 0.19 | 0.16 | 0.18 | 0.43 | 0.68 | 0.38 | 0.26 | 0.03 | 0.10 | 0.07 | 0.07 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.77 | 0.00 | 0.00 | 0.02 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.55 | 0.38 | 0.40 | 0.42 | 0.00 | 0.09 | 0.23 | 0.24 | 0.00 | 0.06 | 0.10 | 0.22 | 0.08 |
| CaO | 0.07 | 7.10 | 4.91 | 3.68 | | | | | | | | | |
| Total | 100.61 | 99.00 | 98.55 | 100.12 | 99.63 | 100.55 | 99.28 | 100.11 | 99.86 | 100.61 | 100.41 | 98.80 | 101.15 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.549 | 0.322 | 0.394 | 0.436 | 0.702 | 0.698 | 0.691 | 0.595 | 0.589 | 0.586 | 0.597 | 0.598 | 0.590 |
| Mn | 0.417 | 0.276 | 0.294 | 0.327 | 0.293 | 0.286 | 0.301 | 0.332 | 0.372 | 0.368 | 0.357 | 0.356 | 0.366 |
| Ti | 0.044 | 0.060 | 0.066 | 0.057 | 0.025 | 0.018 | 0.030 | 0.145 | 0.041 | 0.040 | 0.083 | 0.067 | 0.032 |
| Nb | 1.062 | 0.883 | 0.877 | 0.792 | 1.508 | 1.661 | 1.541 | 1.315 | 0.709 | 0.826 | 0.772 | 0.876 | 0.645 |
| Ta | 0.835 | 0.914 | 0.939 | 1.038 | 0.450 | 0.291 | 0.398 | 0.543 | 1.239 | 1.133 | 1.134 | 1.050 | 1.324 |
| Sn | 0.016 | 0.058 | 0.029 | 0.043 | 0.004 | 0.002 | 0.006 | 0.022 | 0.007 | 0.005 | 0.009 | 0.009 | 0.006 |
| W | 0.038 | 0.024 | 0.057 | 0.046 | 0.014 | 0.023 | 0.020 | 0.023 | 0.023 | 0.017 | 0.029 | 0.019 | 0.013 |
| Pb | 0.003 | 0.004 | 0.003 | 0.003 | 0.007 | 0.011 | 0.006 | 0.005 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.022 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.032 | 0.023 | 0.025 | 0.026 | 0.000 | 0.005 | 0.012 | 0.013 | 0.000 | 0.004 | 0.006 | 0.014 | 0.005 |
| Ca | 0.005 | 0.533 | 0.372 | 0.281 | | | | | | | | | |
| Total | 3.002 | 3.117 | 3.056 | 3.050 | 3.004 | 2.999 | 3.008 | 2.993 | 2.982 | 2.981 | 2.988 | 2.990 | 2.981 |
| Mn/(Mn+Fe | 0.432 | 0.462 | 0.427 | 0.429 | 0.294 | 0.291 | 0.304 | 0.358 | 0.387 | 0.386 | 0.375 | 0.373 | 0.383 |
| Ta/(Ta+Nb) | 0.440 | 0.509 | 0.517 | 0.567 | 0.230 | 0.149 | 0.205 | 0.292 | 0.636 | 0.578 | 0.595 | 0.545 | 0.672 |
| Comments: | LR & LS<br>same grain | | LT & LU<br>same grain | | | CC - CE same grain<br>patchy zonation | | | | VG & VH<br>same grain | | VI & VJ<br>same grain | |
| | | cassiterite-rich sample | | | | | | | | | | | |

| | **Pegmatite 11** | | **Pegmatite 11** | | **SW Beryl pegmatite** | | | | | **SW Beryl pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 95-117B | | 95-117C | | 96-9 | | | | | 96-11A | | | | | |
| | RK | RM | XA | XB | FA | GA | GB | GF | GG | AE | AF | AK | AL | AM | AN |
| FeO | 11.69 | 12.03 | 10.15 | 10.50 | 13.87 | 12.97 | 14.14 | 14.30 | 14.12 | 15.45 | 16.48 | 16.02 | 16.22 | 15.27 | 16.18 |
| MnO | 5.74 | 4.24 | 6.05 | 6.51 | 1.01 | 0.94 | 1.08 | 1.03 | 1.07 | 3.59 | 3.15 | 3.46 | 3.65 | 2.89 | 3.11 |
| TiO2 | 2.85 | 2.27 | 0.78 | 0.81 | 1.71 | 0.53 | 1.81 | 1.79 | 1.46 | 0.68 | 0.76 | 0.80 | 0.64 | 0.68 | 0.65 |
| Nb2O5 | 45.06 | 35.06 | 29.69 | 38.03 | 25.32 | 17.83 | 26.10 | 27.42 | 26.79 | 54.96 | 55.85 | 55.40 | 55.30 | 49.55 | 54.72 |
| Ta2O5 | 30.70 | 43.15 | 52.41 | 42.46 | 55.21 | 64.68 | 55.04 | 53.49 | 54.27 | 23.53 | 22.41 | 23.28 | 22.62 | 27.69 | 23.36 |
| SnO2 | 0.66 | 0.51 | 0.20 | 0.13 | 1.15 | 1.59 | 0.61 | 0.43 | 0.71 | 0.00 | 0.18 | 0.08 | 0.07 | 0.00 | 0.14 |
| WO3 | 2.18 | 1.07 | 0.95 | 1.02 | 0.49 | 0.34 | 0.25 | 0.32 | 0.25 | 0.90 | 1.39 | 1.20 | 0.76 | 0.94 | 1.27 |
| PbO | 0.23 | 0.17 | 0.11 | 0.19 | 0.16 | 0.11 | 0.05 | 0.08 | 0.14 | 0.73 | 0.00 | 0.00 | 0.00 | 1.02 | 0.55 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.56 | 0.00 | 0.55 | 0.09 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.38 | 0.00 | 0.03 | 0.13 | 0.00 |
| Sc2O3 | 0.14 | 0.02 | 0.00 | 0.01 | 0.25 | 0.13 | 0.21 | 0.24 | 0.09 | 0.29 | 0.04 | 0.16 | 0.52 | 0.00 | 0.40 |
| CaO | | | | | 0.00 | 0.01 | 0.02 | 0.01 | 0.02 | | | | | | |
| Total | 99.28 | 98.51 | 100.34 | 99.65 | 99.17 | 99.12 | 99.34 | 99.11 | 98.90 | 100.12 | 100.63 | 100.97 | 99.80 | 98.69 | 100.54 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.630 | 0.691 | 0.600 | 0.596 | 0.840 | 0.831 | 0.851 | 0.856 | 0.853 | 0.805 | 0.849 | 0.825 | 0.841 | 0.829 | 0.839 |
| Mn | 0.313 | 0.247 | 0.362 | 0.374 | 0.062 | 0.061 | 0.066 | 0.063 | 0.066 | 0.189 | 0.164 | 0.181 | 0.192 | 0.159 | 0.163 |
| Ti | 0.138 | 0.117 | 0.041 | 0.042 | 0.093 | 0.031 | 0.098 | 0.096 | 0.080 | 0.032 | 0.035 | 0.037 | 0.030 | 0.033 | 0.030 |
| Nb | 1.311 | 1.089 | 0.949 | 1.168 | 0.829 | 0.618 | 0.849 | 0.887 | 0.875 | 1.547 | 1.556 | 1.542 | 1.549 | 1.455 | 1.535 |
| Ta | 0.537 | 0.806 | 1.007 | 0.784 | 1.087 | 1.348 | 1.077 | 1.041 | 1.067 | 0.398 | 0.376 | 0.390 | 0.381 | 0.489 | 0.394 |
| Sn | 0.017 | 0.014 | 0.006 | 0.004 | 0.033 | 0.048 | 0.017 | 0.012 | 0.020 | 0.000 | 0.005 | 0.002 | 0.002 | 0.000 | 0.004 |
| W | 0.036 | 0.019 | 0.017 | 0.018 | 0.009 | 0.007 | 0.005 | 0.006 | 0.005 | 0.014 | 0.022 | 0.019 | 0.012 | 0.016 | 0.020 |
| Pb | 0.004 | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.001 | 0.002 | 0.003 | 0.012 | 0.000 | 0.000 | 0.000 | 0.018 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.008 | 0.001 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sc | 0.008 | 0.001 | 0.000 | 0.000 | 0.015 | 0.009 | 0.013 | 0.015 | 0.006 | 0.015 | 0.002 | 0.009 | 0.028 | 0.000 | 0.022 |
| Ca | | | | | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | | | | | | |
| Total | 2.995 | 2.988 | 2.984 | 2.990 | 2.973 | 2.955 | 2.979 | 2.979 | 2.975 | 3.013 | 3.015 | 3.012 | 3.035 | 3.010 | 3.019 |
| Mn/(Mn+Fe | 0.332 | 0.263 | 0.376 | 0.386 | 0.069 | 0.068 | 0.072 | 0.068 | 0.071 | 0.190 | 0.162 | 0.180 | 0.186 | 0.161 | 0.163 |
| Ta/(Ta+Nb) | 0.291 | 0.425 | 0.515 | 0.402 | 0.567 | 0.686 | 0.559 | 0.540 | 0.549 | 0.205 | 0.194 | 0.202 | 0.197 | 0.252 | 0.204 |
| Comments: | | | XA & XB | | FA, GA & GB columbite with ferrotapiolite rim | | | | | | | AK - AN same grain | | | |
| | | | same grain | | primary | | | | | | | core | core inter | | rim |
| | | | | | core | | | | | | | | oscillatory zoned | | |

| | **SW Beryl pegmatite** | | | | | **Peg. 12** | **East Beryl pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-11A | | | | | 96-13B | 96-24 | | | | | | |
| | KA | KB | KC | KH | KI | MN | VA | VB | VC | VD | VE | VF | VG |
| FeO | 15.59 | 15.69 | 15.38 | 16.74 | 16.62 | 1.83 | 7.25 | 6.32 | 5.97 | 5.78 | 5.83 | 5.31 | 4.02 |
| MnO | 3.78 | 3.57 | 3.82 | 2.87 | 2.80 | 15.12 | 10.82 | 11.46 | 11.78 | 11.98 | 11.96 | 12.37 | 13.26 |
| TiO2 | 0.71 | 0.66 | 0.69 | 0.55 | 0.40 | 0.53 | 0.12 | 0.15 | 0.16 | 0.16 | 0.15 | 0.18 | 0.13 |
| Nb2O5 | 54.95 | 54.84 | 50.71 | 56.40 | 56.79 | 39.95 | 47.25 | 46.08 | 45.25 | 45.19 | 45.89 | 43.97 | 40.75 |
| Ta2O5 | 24.11 | 24.51 | 27.48 | 21.92 | 22.30 | 38.11 | 33.13 | 34.16 | 35.99 | 35.84 | 34.95 | 36.88 | 39.97 |
| SnO2 | 0.07 | 0.07 | 0.00 | 0.12 | 0.07 | 0.60 | 0.06 | 0.04 | 0.07 | 0.02 | 0.06 | 0.05 | 0.05 |
| WO3 | 1.46 | 1.50 | 1.09 | 0.97 | 0.65 | 1.72 | 0.54 | 0.46 | 0.40 | 0.44 | 0.47 | 0.70 | 0.59 |
| PbO | 0.00 | 0.00 | 0.00 | 0.62 | 0.48 | 0.16 | 0.24 | 0.14 | 0.21 | 0.19 | 0.17 | 0.19 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CaO | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.04 | 0.04 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.01 |
| Total | 100.67 | 100.84 | 99.22 | 100.19 | 100.12 | 98.04 | 99.51 | 98.82 | 99.82 | 99.59 | 99.48 | 99.65 | 98.93 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.806 | 0.812 | 0.820 | 0.867 | 0.860 | 0.104 | 0.395 | 0.349 | 0.328 | 0.318 | 0.320 | 0.294 | 0.228 |
| Mn | 0.198 | 0.187 | 0.206 | 0.150 | 0.147 | 0.872 | 0.597 | 0.640 | 0.656 | 0.669 | 0.665 | 0.694 | 0.761 |
| Ti | 0.033 | 0.031 | 0.033 | 0.025 | 0.019 | 0.027 | 0.006 | 0.007 | 0.008 | 0.008 | 0.008 | 0.009 | 0.006 |
| Nb | 1.537 | 1.534 | 1.462 | 1.578 | 1.589 | 1.230 | 1.393 | 1.374 | 1.345 | 1.345 | 1.363 | 1.317 | 1.248 |
| Ta | 0.405 | 0.412 | 0.477 | 0.369 | 0.375 | 0.706 | 0.587 | 0.613 | 0.644 | 0.642 | 0.624 | 0.664 | 0.736 |
| Sn | 0.002 | 0.002 | 0.000 | 0.003 | 0.002 | 0.016 | 0.002 | 0.001 | 0.002 | 0.000 | 0.001 | 0.001 | 0.001 |
| W | 0.023 | 0.024 | 0.018 | 0.016 | 0.010 | 0.030 | 0.009 | 0.008 | 0.007 | 0.007 | 0.008 | 0.012 | 0.010 |
| Pb | 0.000 | 0.000 | 0.000 | 0.010 | 0.008 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 |
| Ca | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.003 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 |
| Total | 3.005 | 3.001 | 3.020 | 3.019 | 3.012 | 2.992 | 3.002 | 2.995 | 2.993 | 2.995 | 2.994 | 2.995 | 2.995 |
| Mn/(Mn+Fe | 0.197 | 0.187 | 0.201 | 0.148 | 0.146 | 0.893 | 0.602 | 0.647 | 0.667 | 0.678 | 0.675 | 0.702 | 0.770 |
| Ta/(Ta+Nb) | 0.209 | 0.212 | 0.246 | 0.190 | 0.191 | 0.365 | 0.297 | 0.308 | 0.324 | 0.323 | 0.314 | 0.335 | 0.371 |
| Comments: | | KA - KC<br>same grain<br>oscillatory zoned | | | | incl. in<br>cass. MI | VA & VB<br>same grain<br>core | rim | rim | | VC - VG<br>same grain<br>core | | rim |

|  | Big Whopper pegmatite |  |  |  |  |  |  |  | Big Whopper pegmatite |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 96-29A |  |  |  |  |  |  |  | 96-29B |  |  |  |  |  |  |  |
|  | CB | CB | CG | CC | CE | CF | SA | SB | AA | AB | AC | AG | AD | AE | AJ | AK |
| FeO | 6.71 | 6.71 | 6.39 | 5.91 | 7.07 | 7.09 | 4.45 | 4.68 | 8.39 | 7.14 | 8.73 | 8.12 | 9.10 | 10.51 | 9.08 | 8.98 |
| MnO | 12.15 | 12.15 | 12.23 | 11.98 | 11.01 | 11.01 | 10.73 | 9.96 | 7.05 | 6.00 | 7.10 | 6.52 | 7.52 | 7.94 | 6.79 | 6.84 |
| TiO2 | 0.52 | 0.52 | 0.55 | 0.56 | 0.65 | 0.67 | 0.01 | 0.00 | 0.17 | 0.28 | 0.28 | 0.18 | 0.36 | 0.54 | 0.00 | 0.32 |
| Nb2O5 | 54.74 | 54.74 | 51.56 | 45.92 | 47.83 | 47.17 | 17.85 | 9.60 | 18.59 | 14.49 | 25.96 | 14.53 | 20.59 | 38.43 | 14.39 | 16.17 |
| Ta2O5 | 25.23 | 25.23 | 28.63 | 34.15 | 31.68 | 32.39 | 67.45 | 76.36 | 65.75 | 67.05 | 55.94 | 68.90 | 60.00 | 40.22 | 70.08 | 66.45 |
| SnO2 | 0.18 | 0.18 | 0.18 | 0.24 | 0.26 | 0.28 | 0.06 | 0.04 | 0.16 | 2.32 | 0.31 | 0.40 | 0.16 | 0.14 | 0.09 | 0.00 |
| WO3 | 0.18 | 0.18 | 0.31 | 0.18 | 0.23 | 0.25 | 0.24 | 0.30 | 0.32 | 0.36 | 0.49 | 0.30 | 0.31 | 0.82 | 0.10 | 0.49 |
| PbO | 0.31 | 0.31 | 0.29 | 0.28 | 0.27 | 0.28 | 0.05 | 0.08 | 0.08 | 0.03 | 0.08 | 0.15 | 0.47 | 0.07 | 0.00 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.24 | 0.08 | 0.00 | 0.26 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.45 | 0.52 | 0.11 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.10 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.38 | 0.00 | 0.00 | 0.53 |
| CaO |  |  |  |  |  |  | 0.02 | 0.02 | 0.00 | 1.38 | 0.01 | 0.02 |  |  |  |  |
| Total | 100.02 | 100.02 | 100.25 | 99.21 | 99.03 | 99.24 | 100.87 | 101.04 | 100.51 | 99.13 | 98.91 | 99.14 | 99.56 | 99.35 | 100.64 | 100.12 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.350 | 0.350 | 0.338 | 0.324 | 0.384 | 0.386 | 0.282 | 0.311 | 0.531 | 0.464 | 0.536 | 0.533 | 0.572 | 0.598 | 0.588 | 0.574 |
| Mn | 0.643 | 0.643 | 0.655 | 0.666 | 0.606 | 0.607 | 0.689 | 0.671 | 0.452 | 0.395 | 0.441 | 0.433 | 0.478 | 0.458 | 0.446 | 0.443 |
| Ti | 0.024 | 0.024 | 0.026 | 0.027 | 0.032 | 0.033 | 0.001 | 0.000 | 0.010 | 0.016 | 0.016 | 0.010 | 0.020 | 0.028 | 0.000 | 0.019 |
| Nb | 1.546 | 1.546 | 1.474 | 1.362 | 1.405 | 1.387 | 0.612 | 0.345 | 0.635 | 0.509 | 0.861 | 0.515 | 0.699 | 1.182 | 0.504 | 0.559 |
| Ta | 0.429 | 0.429 | 0.492 | 0.609 | 0.560 | 0.573 | 1.391 | 1.652 | 1.352 | 1.418 | 1.116 | 1.470 | 1.226 | 0.744 | 1.476 | 1.381 |
| Sn | 0.004 | 0.004 | 0.005 | 0.006 | 0.007 | 0.007 | 0.002 | 0.001 | 0.005 | 0.072 | 0.009 | 0.013 | 0.005 | 0.004 | 0.003 | 0.000 |
| W | 0.003 | 0.003 | 0.005 | 0.003 | 0.004 | 0.004 | 0.005 | 0.006 | 0.006 | 0.007 | 0.009 | 0.006 | 0.006 | 0.014 | 0.002 | 0.010 |
| Pb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.009 | 0.001 | 0.000 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.002 | 0.000 | 0.008 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 | 0.009 | 0.002 | 0.000 |
| Sc | 0.000 | 0.000 | 0.005 | 0.000 | 0.002 | 0.006 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.025 | 0.000 | 0.000 | 0.035 |
| Ca |  |  |  |  |  |  | 0.002 | 0.001 | 0.000 | 0.115 | 0.001 | 0.001 |  |  |  |  |
| Total | 3.004 | 3.004 | 3.006 | 3.003 | 3.005 | 3.008 | 2.984 | 2.990 | 2.992 | 3.003 | 2.991 | 2.986 | 3.056 | 3.043 | 3.021 | 3.030 |
| Mn/(Mn+Fe | 0.647 | 0.647 | 0.660 | 0.673 | 0.612 | 0.611 | 0.709 | 0.683 | 0.460 | 0.460 | 0.452 | 0.448 | 0.456 | 0.434 | 0.431 | 0.435 |
| Ta/(Ta+Nb) | 0.217 | 0.217 | 0.250 | 0.309 | 0.285 | 0.292 | 0.694 | 0.827 | 0.680 | 0.736 | 0.565 | 0.740 | 0.637 | 0.386 | 0.746 | 0.712 |
| Comments: | two sections two different compositions |  |  | attached to cass. CD | CE & CF same grain |  | SA & SB same grain |  |  | AA - AC same grain |  |  | high Bi | high Bi |  |  |

**Big Whopper pegmatite**

96-29B

| | BA | BB | BC | BD | BE | BF | BG | BI | BJ | BM | BN | BQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 6.57 | 6.30 | 0.68 | 3.14 | 7.93 | 8.25 | 8.34 | 7.85 | 8.30 | 8.91 | 9.01 | 8.55 |
| MnO | 8.25 | 8.53 | 14.12 | 11.90 | 6.75 | 6.68 | 6.54 | 7.88 | 7.50 | 6.87 | 6.90 | 6.49 |
| TiO2 | 0.21 | 0.14 | 0.09 | 0.15 | 0.27 | 0.27 | 0.16 | 0.58 | 0.83 | 0.46 | 0.35 | 0.59 |
| Nb2O5 | 13.03 | 13.43 | 12.86 | 14.14 | 15.15 | 14.99 | 12.59 | 22.27 | 25.59 | 22.04 | 23.72 | 16.32 |
| Ta2O5 | 70.96 | 69.87 | 71.51 | 70.22 | 67.63 | 68.77 | 70.42 | 60.57 | 56.34 | 61.11 | 58.73 | 66.47 |
| SnO2 | 0.31 | 0.92 | 0.03 | 0.29 | 0.21 | 0.29 | 0.58 | 0.03 | 0.39 | 0.00 | 0.15 | 0.37 |
| WO3 | 0.33 | 0.00 | 0.61 | 0.20 | 0.20 | 0.00 | 0.29 | 0.56 | 0.35 | 0.13 | 0.42 | 0.04 |
| PbO | 0.00 | 0.34 | 0.67 | 0.03 | 0.42 | 0.00 | 0.65 | 0.00 | 0.00 | 0.00 | 0.22 | 0.68 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| UO2 | 0.15 | 0.00 | 0.08 | 0.19 | 0.00 | 0.00 | 0.44 | 0.04 | 0.05 | 0.00 | 0.00 | 0.23 |
| Sb2O3 | 0.00 | 0.00 | 0.11 | 0.19 | 0.14 | 0.07 | 0.00 | 0.17 | 0.00 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | 0.57 | 0.55 | 0.00 | 0.07 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.60 | 0.00 | 0.00 | 0.09 | 0.00 | 0.40 | 0.22 | 0.62 | 0.00 | 0.66 | 0.65 |
| CaO | | | | | | | | | | | | |
| Total | 100.40 | 100.68 | 100.77 | 100.52 | 98.80 | 99.33 | 100.43 | 100.17 | 99.95 | 99.52 | 100.17 | 100.50 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.431 | 0.410 | 0.045 | 0.204 | 0.520 | 0.538 | 0.548 | 0.484 | 0.501 | 0.555 | 0.551 | 0.545 |
| Mn | 0.548 | 0.561 | 0.937 | 0.783 | 0.449 | 0.441 | 0.434 | 0.492 | 0.458 | 0.434 | 0.428 | 0.419 |
| Ti | 0.013 | 0.008 | 0.005 | 0.008 | 0.016 | 0.016 | 0.010 | 0.032 | 0.045 | 0.026 | 0.019 | 0.034 |
| Nb | 0.461 | 0.472 | 0.455 | 0.496 | 0.537 | 0.529 | 0.447 | 0.743 | 0.834 | 0.743 | 0.785 | 0.563 |
| Ta | 1.512 | 1.477 | 1.523 | 1.483 | 1.442 | 1.458 | 1.503 | 1.215 | 1.105 | 1.238 | 1.168 | 1.379 |
| Sn | 0.010 | 0.028 | 0.001 | 0.009 | 0.007 | 0.009 | 0.018 | 0.001 | 0.011 | 0.000 | 0.004 | 0.011 |
| W | 0.007 | 0.000 | 0.012 | 0.004 | 0.004 | 0.000 | 0.006 | 0.011 | 0.006 | 0.003 | 0.008 | 0.001 |
| Pb | 0.000 | 0.007 | 0.014 | 0.001 | 0.009 | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.004 | 0.014 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| U | 0.003 | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.008 | 0.001 | 0.001 | 0.000 | 0.000 | 0.004 |
| Sb | 0.000 | 0.000 | 0.004 | 0.006 | 0.004 | 0.002 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.012 | 0.011 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.041 | 0.000 | 0.000 | 0.006 | 0.000 | 0.027 | 0.014 | 0.039 | 0.000 | 0.042 | 0.043 |
| Ca | | | | | | | | | | | | |
| Total | 2.995 | 3.015 | 2.998 | 2.999 | 2.995 | 2.993 | 3.014 | 2.998 | 3.001 | 2.998 | 3.010 | 3.014 |
| Mn/(Mn+Fe | 0.560 | 0.578 | 0.955 | 0.793 | 0.463 | 0.450 | 0.442 | 0.504 | 0.478 | 0.439 | 0.437 | 0.435 |
| Ta/(Ta+Nb) | 0.766 | 0.758 | 0.770 | 0.749 | 0.729 | 0.734 | 0.771 | 0.621 | 0.570 | 0.625 | 0.598 | 0.710 |
| Comments: | BA - BI same grain, BA - BG primary, BI & BJ secondary | | | | | | | | | | | |
| | core | inter | inter | inter | rim | rim | rim | | | | | |
| | high Bi | high Bi | | | | | | | | | | |

### Big Whopper pegmatite

96-29B

| | HA | HB | HC | HD1 | HD2 | HD3 | HD4 | HD5 | HD6 | HD7 | HD8 | HD9 | HD10 | HE | HF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.22 | 3.16 | 5.96 | 7.56 | 2.08 | 0.23 | 0.36 | 4.76 | 6.13 | 6.65 | 7.48 | 6.82 | 6.73 | 8.12 | 8.22 |
| MnO | 6.93 | 11.61 | 9.00 | 7.51 | 13.01 | 14.68 | 14.33 | 10.14 | 8.83 | 8.15 | 8.61 | 8.00 | 8.05 | 6.78 | 7.03 |
| TiO2 | | | | | | | | | | | | | | | |
| Nb2O5 | 14.97 | 13.19 | 13.97 | 15.47 | 15.42 | 14.10 | 13.40 | 13.78 | 13.73 | 12.81 | 27.56 | 13.31 | 12.66 | 14.30 | 17.12 |
| Ta2O5 | 68.38 | 70.86 | 69.82 | 67.95 | 68.31 | 69.98 | 70.49 | 70.03 | 69.62 | 70.84 | 53.82 | 69.60 | 70.54 | 69.14 | 66.12 |
| SnO2 | 0.13 | 0.21 | 0.20 | 0.15 | 0.16 | 0.23 | 0.19 | 0.17 | 0.55 | 0.70 | 0.33 | 0.61 | 0.60 | 0.49 | 0.11 |
| WO3 | 0.30 | 0.39 | 0.30 | 0.35 | 0.33 | 0.40 | 0.28 | 0.27 | 0.22 | 0.24 | 0.46 | 0.26 | 0.23 | 0.24 | 0.28 |
| PbO | 0.05 | 0.00 | 0.01 | 0.04 | 0.01 | 0.06 | 0.06 | 0.01 | 0.08 | 0.00 | 0.12 | 0.03 | 0.01 | 0.06 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.04 | 0.00 | 0.02 | 0.02 | 0.05 | 0.04 | 0.00 | 0.01 |
| Sc2O3 | 0.03 | 0.06 | 0.12 | 0.05 | 0.00 | 0.00 | 0.08 | 0.03 | 0.03 | 0.05 | 0.04 | 0.09 | 0.00 | 0.08 | 0.05 |
| CaO | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.05 | 0.02 | 0.00 | 0.00 |
| Total | 99.19 | 99.56 | 99.49 | 99.25 | 99.43 | 99.77 | 99.32 | 99.31 | 99.43 | 99.59 | 99.33 | 98.92 | 99.01 | 99.42 | 99.17 |

**Structural formulae based on 6 oxygens**

| | HA | HB | HC | HD1 | HD2 | HD3 | HD4 | HD5 | HD6 | HD7 | HD8 | HD9 | HD10 | HE | HF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.537 | 0.208 | 0.390 | 0.492 | 0.135 | 0.015 | 0.024 | 0.313 | 0.402 | 0.438 | 0.451 | 0.451 | 0.447 | 0.531 | 0.531 |
| Mn | 0.458 | 0.774 | 0.597 | 0.495 | 0.857 | 0.971 | 0.956 | 0.675 | 0.587 | 0.544 | 0.525 | 0.536 | 0.541 | 0.449 | 0.459 |
| Ti | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 0.529 | 0.469 | 0.495 | 0.544 | 0.542 | 0.498 | 0.477 | 0.490 | 0.487 | 0.457 | 0.897 | 0.476 | 0.454 | 0.506 | 0.597 |
| Ta | 1.453 | 1.517 | 1.488 | 1.439 | 1.444 | 1.487 | 1.510 | 1.498 | 1.485 | 1.519 | 1.054 | 1.497 | 1.522 | 1.470 | 1.388 |
| Sn | 0.004 | 0.007 | 0.006 | 0.005 | 0.005 | 0.007 | 0.006 | 0.005 | 0.017 | 0.022 | 0.010 | 0.019 | 0.019 | 0.015 | 0.003 |
| W | 0.006 | 0.008 | 0.006 | 0.007 | 0.007 | 0.008 | 0.006 | 0.006 | 0.005 | 0.005 | 0.009 | 0.005 | 0.005 | 0.005 | 0.006 |
| Pb | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.000 | 0.002 | 0.001 | 0.000 | 0.001 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| Sc | 0.002 | 0.004 | 0.008 | 0.003 | 0.000 | 0.000 | 0.006 | 0.002 | 0.002 | 0.003 | 0.003 | 0.006 | 0.000 | 0.005 | 0.003 |
| Ca | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.005 | 0.001 | 0.000 | 0.000 |
| Total | 3.011 | 2.996 | 3.003 | 3.004 | 3.002 | 2.999 | 2.998 | 3.000 | 3.015 | 3.004 | 3.044 | 3.008 | 3.006 | 3.008 | 3.006 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe | 0.460 | 0.788 | 0.605 | 0.502 | 0.864 | 0.985 | 0.976 | 0.683 | 0.593 | 0.554 | 0.538 | 0.543 | 0.548 | 0.458 | 0.464 |
| Ta/(Ta+Nb) | 0.733 | 0.764 | 0.750 | 0.726 | 0.727 | 0.749 | 0.760 | 0.754 | 0.753 | 0.769 | 0.540 | 0.759 | 0.770 | 0.744 | 0.699 |

Comments: HA - HI same grain HD = 163 μm traverse away from patchy zoned part of grain
slightly banded and wih some patchy alteration

**Big Whopper pegmatite**

96-29B

| | HG1 | HG2 | HG3 | HG4 | HG5 | HG6 | HG7 | HG8 | HG9 | HG10 | HI | HJ | HK | HL1 | HL2 | HL3 | HL4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.02 | 7.91 | 8.10 | 8.12 | 8.19 | 7.77 | 7.73 | 7.90 | 8.28 | 8.72 | 8.29 | 8.50 | 8.77 | 8.74 | 8.75 | 8.38 | 9.42 |
| MnO | 7.04 | 7.02 | 7.31 | 7.35 | 7.48 | 7.00 | 7.27 | 7.24 | 7.24 | 6.94 | 6.65 | 6.53 | 6.52 | 6.66 | 6.73 | 6.70 | 7.06 |
| TiO2 | | | | | | | | | | | | | | 0.43 | 0.35 | 0.18 | 0.50 |
| Nb2O5 | 15.36 | 14.05 | 19.47 | 20.13 | 21.71 | 21.41 | 15.57 | 16.87 | 20.83 | 21.60 | 13.97 | 15.65 | 18.19 | 20.69 | 21.64 | 16.44 | 32.37 |
| Ta2O5 | 68.19 | 69.84 | 62.77 | 62.55 | 61.29 | 63.72 | 67.91 | 65.88 | 61.68 | 60.99 | 69.42 | 68.02 | 64.90 | 62.29 | 61.29 | 67.77 | 49.99 |
| SnO2 | 0.20 | 0.09 | 0.36 | 0.20 | 0.19 | 0.74 | 0.51 | 0.88 | 0.28 | 0.22 | 0.17 | 0.13 | 0.35 | 0.61 | 0.17 | 0.13 | 0.18 |
| WO3 | 0.29 | 0.27 | 0.34 | 0.26 | 0.23 | 0.36 | 0.28 | 0.28 | 0.29 | 0.29 | 0.30 | 0.28 | 0.35 | 0.31 | 0.32 | 0.27 | 0.47 |
| PbO | 0.11 | 0.07 | 0.12 | 0.03 | 0.10 | 0.06 | 0.05 | 0.04 | 0.17 | 0.14 | 0.04 | 0.03 | 0.04 | 0.08 | 0.15 | 0.00 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.03 | 0.03 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| Sc2O3 | 0.02 | 0.00 | 0.20 | 0.00 | 0.02 | 0.06 | 0.08 | 0.00 | 0.00 | 0.02 | 0.02 | 0.12 | 0.00 | 0.09 | 0.04 | 0.00 | 0.09 |
| CaO | 0.00 | 0.01 | 0.06 | 0.01 | 0.00 | 0.59 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.04 | 0.02 | 0.01 | 0.00 |
| Total | 99.40 | 99.41 | 99.09 | 99.07 | 99.68 | 102.19 | 99.60 | 99.37 | 99.17 | 99.30 | 99.07 | 99.36 | 99.65 | 99.93 | 99.50 | 99.88 | 100.27 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | | |
| Fe | 0.522 | 0.520 | 0.514 | 0.514 | 0.511 | 0.474 | 0.501 | 0.508 | 0.522 | 0.546 | 0.546 | 0.553 | 0.558 | 0.546 | 0.547 | 0.540 | 0.551 |
| Mn | 0.464 | 0.467 | 0.470 | 0.471 | 0.473 | 0.432 | 0.477 | 0.472 | 0.462 | 0.440 | 0.443 | 0.430 | 0.420 | 0.422 | 0.427 | 0.437 | 0.418 |
| Ti | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.024 | 0.020 | 0.010 | 0.026 |
| Nb | 0.541 | 0.499 | 0.668 | 0.689 | 0.732 | 0.706 | 0.546 | 0.587 | 0.710 | 0.732 | 0.497 | 0.550 | 0.625 | 0.700 | 0.732 | 0.572 | 1.023 |
| Ta | 1.444 | 1.491 | 1.295 | 1.288 | 1.243 | 1.264 | 1.431 | 1.379 | 1.264 | 1.243 | 1.486 | 1.438 | 1.342 | 1.267 | 1.247 | 1.419 | 0.950 |
| Sn | 0.006 | 0.003 | 0.011 | 0.006 | 0.006 | 0.021 | 0.016 | 0.027 | 0.008 | 0.006 | 0.005 | 0.004 | 0.010 | 0.018 | 0.005 | 0.004 | 0.005 |
| W | 0.006 | 0.005 | 0.007 | 0.005 | 0.004 | 0.007 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 | 0.007 | 0.006 | 0.006 | 0.005 | 0.009 |
| Pb | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.001 | 0.001 | 0.001 | 0.002 | 0.003 | 0.000 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | 0.001 | 0.000 | 0.013 | 0.000 | 0.001 | 0.004 | 0.006 | 0.000 | 0.000 | 0.001 | 0.001 | 0.008 | 0.000 | 0.006 | 0.002 | 0.000 | 0.005 |
| Ca | 0.000 | 0.001 | 0.005 | 0.001 | 0.000 | 0.046 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.003 | 0.001 | 0.001 | 0.000 |
| Total | 3.004 | 3.001 | 3.025 | 3.019 | 3.021 | 3.007 | 3.004 | 3.013 | 3.020 | 3.020 | 3.006 | 3.000 | 3.024 | 2.993 | 2.992 | 2.988 | 2.990 |
| Mn/(Mn+Fe | 0.471 | 0.473 | 0.477 | 0.478 | 0.481 | 0.477 | 0.488 | 0.482 | 0.470 | 0.446 | 0.448 | 0.438 | 0.430 | 0.436 | 0.438 | 0.447 | 0.431 |
| Ta/(Ta+Nb) | 0.728 | 0.749 | 0.660 | 0.651 | 0.629 | 0.642 | 0.724 | 0.701 | 0.640 | 0.629 | 0.749 | 0.723 | 0.682 | 0.644 | 0.630 | 0.713 | 0.482 |

Comments: HG = 224 μm traverse in patchy zoned part of grain

HJ & HK same grain limited patchy alteration at margin

HL traverse across 120 μm grain slightly patchy

| | | | | | | Big Whopper pegmatite | | | | | | | | Big Whopper | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 96-29C | | | | | | | | 96-29D | |
| | AA | AB | DA | DB | DC | DH | DI | DK | DL | DM | DN | DP | DQ | RL1 | RL2 |
| FeO | 0.99 | 0.88 | 0.65 | 0.51 | 0.63 | 0.70 | 0.73 | 0.52 | 0.54 | 0.55 | 0.45 | 0.51 | 0.65 | 7.14 | 10.26 |
| MnO | 15.49 | 15.65 | 15.84 | 16.81 | 15.93 | 16.22 | 16.42 | 16.07 | 15.99 | 16.40 | 14.26 | 16.12 | 15.56 | 7.13 | 6.94 |
| TiO2 | 0.30 | 0.19 | 0.11 | 0.10 | 0.24 | 0.15 | 0.16 | 0.02 | 0.09 | 0.05 | 0.19 | 0.12 | 0.15 | 0.57 | 0.66 |
| Nb2O5 | 31.78 | 32.12 | 31.14 | 40.95 | 33.32 | 35.48 | 38.24 | 34.01 | 33.71 | 37.35 | 14.20 | 33.00 | 28.94 | 25.14 | 40.68 |
| Ta2O5 | 51.04 | 50.80 | 52.30 | 41.34 | 49.25 | 45.58 | 44.07 | 48.58 | 49.39 | 45.31 | 70.07 | 49.93 | 54.31 | 55.94 | 37.47 |
| SnO2 | 0.00 | 0.23 | 0.07 | 0.06 | 0.16 | 0.06 | 0.10 | 0.05 | 0.09 | 0.02 | 0.36 | 0.07 | 0.14 | 1.15 | 0.33 |
| WO3 | 0.67 | 0.40 | 0.24 | 0.35 | 0.48 | 0.33 | 0.53 | 0.26 | 0.28 | 0.24 | 0.21 | 0.37 | 0.29 | 0.83 | 0.68 |
| PbO | 0.00 | 0.00 | 0.15 | 0.19 | 0.07 | 0.15 | 0.23 | 0.20 | 0.09 | 0.21 | 0.02 | 0.14 | 0.16 | 0.14 | 0.19 |
| ThO2 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.26 | 0.00 | 0.06 | 0.00 | 0.00 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.12 |
| CaO | | | | | | | | | | | | | | 1.41 | 0.02 |
| Total | 100.27 | 100.71 | 100.49 | 100.39 | 100.08 | 98.66 | 100.56 | 99.74 | 100.18 | 100.13 | 99.76 | 100.28 | 100.20 | 99.58 | 97.31 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.058 | 0.051 | 0.038 | 0.028 | 0.037 | 0.041 | 0.041 | 0.030 | 0.031 | 0.031 | 0.030 | 0.030 | 0.039 | 0.434 | 0.586 |
| Mn | 0.920 | 0.924 | 0.945 | 0.953 | 0.941 | 0.959 | 0.942 | 0.951 | 0.943 | 0.951 | 0.943 | 0.954 | 0.942 | 0.438 | 0.401 |
| Ti | 0.016 | 0.010 | 0.006 | 0.005 | 0.012 | 0.008 | 0.008 | 0.001 | 0.005 | 0.003 | 0.011 | 0.007 | 0.008 | 0.031 | 0.034 |
| Nb | 1.008 | 1.013 | 0.992 | 1.239 | 1.050 | 1.119 | 1.171 | 1.074 | 1.062 | 1.155 | 0.501 | 1.042 | 0.935 | 0.825 | 1.255 |
| Ta | 0.974 | 0.964 | 1.002 | 0.752 | 0.934 | 0.865 | 0.812 | 0.923 | 0.936 | 0.843 | 1.487 | 0.948 | 1.055 | 1.105 | 0.695 |
| Sn | 0.000 | 0.007 | 0.002 | 0.002 | 0.004 | 0.002 | 0.003 | 0.001 | 0.003 | 0.001 | 0.011 | 0.002 | 0.004 | 0.033 | 0.009 |
| W | 0.012 | 0.007 | 0.004 | 0.006 | 0.009 | 0.006 | 0.009 | 0.005 | 0.005 | 0.004 | 0.004 | 0.007 | 0.005 | 0.016 | 0.012 |
| Pb | 0.000 | 0.000 | 0.003 | 0.003 | 0.001 | 0.003 | 0.004 | 0.004 | 0.002 | 0.004 | 0.000 | 0.003 | 0.003 | 0.003 | 0.003 |
| Th | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.016 | 0.000 | 0.003 | 0.000 | 0.000 | 0.003 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 | 0.007 |
| Ca | | | | | | | | | | | | | | 0.110 | 0.002 |
| Total | 2.987 | 2.994 | 2.992 | 2.992 | 2.989 | 3.002 | 2.994 | 2.991 | 2.986 | 2.991 | 2.987 | 2.992 | 2.992 | 3.004 | 3.004 |
| Mn/(Mn+Fe | 0.941 | 0.947 | 0.961 | 0.971 | 0.962 | 0.959 | 0.958 | 0.969 | 0.968 | 0.968 | 0.970 | 0.970 | 0.960 | 0.503 | 0.407 |
| Ta/(Ta+Nb) | 0.491 | 0.488 | 0.503 | 0.378 | 0.471 | 0.436 | 0.409 | 0.462 | 0.468 | 0.422 | 0.748 | 0.476 | 0.530 | 0.572 | 0.357 |
| Comments: | AA & AB same grain | | DA - DC same grain core to rim<br>occurring in clusters and with oscillatory zonation | | | DH & DI same grain | | DK & DL same grain | | | | | | inclusions in cassiterite | |

| | **Big Whopper pegmatite** | | | | | | **Big Whopper pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-29F | | | | | | 96-29G | | | | | |
| | RA | RB | RC | RD | RE | RF | FI | EH | EI | EJ | EK | EM |
| FeO | 1.90 | 1.51 | 1.28 | 2.11 | 2.19 | 2.15 | 1.40 | 12.62 | 12.73 | 12.64 | 12.60 | 10.84 |
| MnO | 15.84 | 15.85 | 15.30 | 16.51 | 16.26 | 15.01 | 15.83 | 6.66 | 6.87 | 6.85 | 6.84 | 6.04 |
| TiO2 | 0.28 | 0.11 | 0.29 | 0.40 | 0.54 | 0.65 | 0.44 | 0.27 | 0.26 | 0.25 | 0.27 | 0.21 |
| Nb2O5 | 44.27 | 38.92 | 31.14 | 50.17 | 52.55 | 38.13 | 43.21 | 52.92 | 56.37 | 58.18 | 57.22 | 29.75 |
| Ta2O5 | 36.00 | 42.43 | 50.62 | 29.90 | 27.19 | 40.93 | 35.59 | 27.38 | 23.38 | 21.23 | 22.01 | 52.28 |
| SnO2 | 0.00 | 0.18 | 0.00 | 0.12 | 0.12 | 0.11 | 0.02 | 0.06 | 0.08 | 0.03 | 0.06 | 0.09 |
| WO3 | 0.20 | 0.49 | 0.03 | 1.15 | 1.01 | 1.34 | 2.32 | 0.49 | 0.39 | 0.39 | 0.42 | 0.34 |
| PbO | 0.18 | 0.00 | 0.42 | 0.00 | 0.49 | 0.49 | 0.27 | 0.27 | 0.28 | 0.25 | 0.29 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.03 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.12 | 0.38 | 0.08 | 0.21 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.30 | 0.00 | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.38 | 0.17 | 0.77 | 0.00 | 0.00 | 1.17 | 0.04 | 0.13 | 0.11 | 0.07 | 0.00 | 0.00 |
| CaO | | | | | | | 0.04 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 |
| Total | 99.06 | 100.09 | 100.25 | 100.58 | 100.56 | 100.12 | 99.12 | 100.81 | 100.46 | 99.91 | 99.71 | 99.71 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.105 | 0.086 | 0.075 | 0.112 | 0.115 | 0.121 | 0.078 | 0.662 | 0.658 | 0.651 | 0.653 | 0.647 |
| Mn | 0.888 | 0.909 | 0.910 | 0.888 | 0.866 | 0.855 | 0.891 | 0.354 | 0.360 | 0.357 | 0.359 | 0.365 |
| Ti | 0.014 | 0.006 | 0.015 | 0.019 | 0.026 | 0.033 | 0.022 | 0.013 | 0.012 | 0.012 | 0.012 | 0.011 |
| Nb | 1.325 | 1.191 | 0.988 | 1.440 | 1.493 | 1.159 | 1.298 | 1.500 | 1.576 | 1.620 | 1.603 | 0.960 |
| Ta | 0.648 | 0.781 | 0.966 | 0.516 | 0.465 | 0.748 | 0.643 | 0.467 | 0.393 | 0.355 | 0.371 | 1.015 |
| Sn | 0.000 | 0.005 | 0.000 | 0.003 | 0.003 | 0.003 | 0.000 | 0.002 | 0.002 | 0.001 | 0.001 | 0.003 |
| W | 0.003 | 0.009 | 0.001 | 0.019 | 0.016 | 0.023 | 0.040 | 0.008 | 0.006 | 0.006 | 0.007 | 0.006 |
| Pb | 0.003 | 0.000 | 0.008 | 0.000 | 0.008 | 0.009 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.003 | 0.011 | 0.002 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.022 | 0.010 | 0.047 | 0.000 | 0.000 | 0.069 | 0.002 | 0.007 | 0.006 | 0.004 | 0.000 | 0.000 |
| Ca | | | | | | | 0.003 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| Total | 3.009 | 3.005 | 3.022 | 3.002 | 2.998 | 3.022 | 2.983 | 3.016 | 3.018 | 3.010 | 3.012 | 3.011 |
| Mn/(Mn+Fe | 0.894 | 0.914 | 0.924 | 0.888 | 0.883 | 0.876 | 0.920 | 0.348 | 0.353 | 0.354 | 0.355 | 0.361 |
| Ta/(Ta+Nb) | 0.328 | 0.396 | 0.494 | 0.264 | 0.237 | 0.392 | 0.331 | 0.237 | 0.200 | 0.180 | 0.188 | 0.514 |
| Comments: | RA - RD | | | | RE & RF | | | EH & EI | | | EJ - EM | |
| | same grain | | | | same grain | | | same grain | | | same grain | |
| | oscillatory zoned core to rim | | | | | | | core | rim | primary | | secondary |

**Big Whopper pegmatite**

96-29G

| | CA | CB | CC | CD | CE | CF | CG | CH | CK | EE | EF | EG | EH | EI | EJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 9.12 | 10.77 | 10.67 | 10.71 | 9.97 | 10.75 | 9.86 | 9.91 | 10.34 | 11.41 | 9.46 | 11.08 | 9.85 | 5.82 | 10.56 |
| MnO | 8.16 | 8.22 | 8.51 | 8.62 | 8.06 | 7.85 | 6.94 | 7.64 | 8.47 | 8.08 | 8.14 | 8.03 | 7.60 | 12.81 | 8.37 |
| TiO2 | 0.32 | 0.24 | 0.51 | 0.12 | 0.61 | 0.44 | 0.74 | 0.61 | 0.34 | 0.29 | 0.37 | 0.42 | 0.42 | 0.28 | 0.29 |
| Nb2O5 | 38.37 | 59.88 | 57.01 | 59.08 | 44.78 | 51.85 | 33.92 | 39.56 | 52.71 | 59.02 | 39.57 | 55.20 | 35.50 | 51.49 | 52.57 |
| Ta2O5 | 43.04 | 19.85 | 22.37 | 20.99 | 34.80 | 27.65 | 44.56 | 41.43 | 26.61 | 19.99 | 41.24 | 23.49 | 45.88 | 28.14 | 27.32 |
| SnO2 | 0.00 | 0.02 | 0.00 | 0.00 | 0.39 | 0.17 | 0.00 | 0.07 | 0.00 | 0.14 | 0.02 | 0.23 | 0.00 | 0.12 | 0.00 |
| WO3 | 0.85 | 0.40 | 0.93 | 0.53 | 1.32 | 0.85 | 1.73 | 1.68 | 0.87 | 0.55 | 0.95 | 0.98 | 0.59 | 1.08 | 0.53 |
| PbO | 0.16 | 0.65 | 0.39 | 0.48 | 0.42 | 0.37 | 0.60 | 0.34 | 0.69 | 0.18 | 0.08 | 0.20 | 0.00 | 0.39 | 0.00 |
| ThO2 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.42 | 0.04 | 0.00 | 0.66 | 0.00 | 0.51 | 0.00 | 0.20 | 0.38 | 0.00 | 0.34 | 0.00 | 0.10 | 0.11 |
| Sb2O3 | 0.14 | 0.00 | 0.00 | 0.23 | 0.07 | 0.00 | 0.04 | 0.04 | 0.05 | 0.07 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 |
| Bi2O3 | 0.06 | 0.19 | 0.00 | 0.00 | 0.00 | 0.47 | 0.31 | 0.00 | 0.05 | 0.25 | 0.00 | 0.18 | 0.04 | 0.26 | 0.13 |
| Sc2O3 | 0.40 | 0.00 | 0.00 | 0.25 | 0.00 | 0.37 | 0.91 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CaO | | | | | | | | | | | | | | | |
| Total | 100.81 | 100.63 | 100.43 | 101.01 | 101.08 | 100.76 | 100.12 | 101.28 | 100.34 | 100.59 | 99.82 | 100.15 | 99.87 | 100.62 | 99.88 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.514 | 0.550 | 0.550 | 0.546 | 0.543 | 0.566 | 0.569 | 0.552 | 0.546 | 0.582 | 0.534 | 0.578 | 0.568 | 0.308 | 0.559 |
| Mn | 0.465 | 0.425 | 0.444 | 0.445 | 0.444 | 0.419 | 0.406 | 0.431 | 0.453 | 0.418 | 0.465 | 0.424 | 0.443 | 0.687 | 0.448 |
| Ti | 0.016 | 0.011 | 0.024 | 0.006 | 0.030 | 0.021 | 0.038 | 0.030 | 0.016 | 0.013 | 0.019 | 0.020 | 0.022 | 0.014 | 0.014 |
| Nb | 1.169 | 1.653 | 1.588 | 1.627 | 1.318 | 1.476 | 1.058 | 1.192 | 1.505 | 1.628 | 1.207 | 1.555 | 1.106 | 1.474 | 1.503 |
| Ta | 0.789 | 0.330 | 0.375 | 0.348 | 0.616 | 0.474 | 0.836 | 0.751 | 0.457 | 0.332 | 0.757 | 0.398 | 0.860 | 0.485 | 0.470 |
| Sn | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 | 0.004 | 0.000 | 0.002 | 0.000 | 0.003 | 0.001 | 0.006 | 0.000 | 0.003 | 0.000 |
| W | 0.015 | 0.006 | 0.015 | 0.008 | 0.022 | 0.014 | 0.031 | 0.029 | 0.014 | 0.009 | 0.017 | 0.016 | 0.011 | 0.018 | 0.009 |
| Pb | 0.003 | 0.011 | 0.006 | 0.008 | 0.007 | 0.006 | 0.011 | 0.006 | 0.012 | 0.003 | 0.001 | 0.003 | 0.000 | 0.007 | 0.000 |
| Th | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.006 | 0.000 | 0.000 | 0.010 | 0.000 | 0.008 | 0.000 | 0.003 | 0.005 | 0.000 | 0.005 | 0.000 | 0.001 | 0.002 |
| Sb | 0.004 | 0.000 | 0.000 | 0.006 | 0.002 | 0.000 | 0.001 | 0.001 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 |
| Bi | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 0.008 | 0.006 | 0.000 | 0.001 | 0.004 | 0.000 | 0.003 | 0.001 | 0.004 | 0.002 |
| Sc | 0.023 | 0.000 | 0.000 | 0.013 | 0.000 | 0.020 | 0.055 | 0.000 | 0.000 | 0.012 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ca | | | | | | | | | | | | | | | |
| Total | 3.001 | 2.995 | 3.002 | 3.006 | 3.003 | 3.008 | 3.019 | 2.995 | 3.008 | 3.012 | 3.001 | 3.007 | 3.009 | 3.004 | 3.007 |
| Mn/(Mn+Fe) | 0.475 | 0.436 | 0.447 | 0.449 | 0.450 | 0.425 | 0.416 | 0.439 | 0.453 | 0.418 | 0.466 | 0.423 | 0.439 | 0.690 | 0.445 |
| Ta/(Ta+Nb) | 0.403 | 0.166 | 0.191 | 0.176 | 0.319 | 0.243 | 0.441 | 0.387 | 0.233 | 0.169 | 0.385 | 0.204 | 0.437 | 0.247 | 0.238 |
| Comments: | | | | | | | | | | EE - EG same grain | | | EH & EI same grain | | |
| | | | | | | | | | | core/interrim | | rim | core | rim | |
| | | | | | | | | | | | | | | odd comp. | |

**Big Whopper pegmatite**

96-29G

| | EK | EL | EM | EN | EO | EQ | GA | GB | GC | GD | GE | GF | GG | GH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.17 | 10.39 | 10.49 | 9.03 | 5.25 | 11.19 | 11.66 | 12.66 | 12.53 | 12.41 | 12.55 | 12.43 | 11.91 | 3.52 |
| MnO | 8.68 | 8.59 | 8.62 | 10.11 | 13.55 | 8.82 | 7.17 | 6.80 | 6.80 | 6.68 | 6.62 | 6.57 | 6.97 | 15.06 |
| TiO2 | 0.63 | 0.24 | 0.44 | 0.11 | 0.02 | 0.29 | | | | | | | | |
| Nb2O5 | 51.20 | 53.70 | 50.86 | 51.61 | 52.13 | 58.36 | 52.39 | 58.33 | 57.39 | 55.03 | 53.97 | 52.91 | 53.57 | 54.28 |
| Ta2O5 | 25.92 | 25.55 | 28.26 | 28.34 | 28.28 | 20.07 | 27.77 | 21.06 | 22.41 | 25.46 | 26.00 | 27.13 | 26.77 | 24.17 |
| SnO2 | 0.43 | 0.25 | 0.18 | 0.15 | 0.24 | 0.14 | 0.02 | 0.17 | 0.05 | 0.06 | 0.09 | 0.03 | 0.07 | 0.05 |
| WO3 | 1.65 | 0.20 | 0.51 | 0.50 | 0.60 | 0.78 | 0.60 | 0.45 | 0.46 | 0.50 | 0.45 | 0.51 | 0.50 | 0.99 |
| PbO | 0.35 | 0.15 | 0.55 | 0.00 | 0.26 | 0.55 | 0.17 | 0.34 | 0.28 | 0.21 | 0.26 | 0.24 | 0.23 | 0.27 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.24 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.23 | 0.11 | 0.00 | 0.00 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.61 | 0.26 | 0.23 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| CaO | | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 |
| Total | 99.51 | 100.00 | 100.16 | 100.08 | 100.36 | 100.44 | 100.06 | 100.10 | 100.17 | 100.61 | 100.19 | 100.14 | 100.34 | 98.70 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.542 | 0.545 | 0.557 | 0.478 | 0.278 | 0.574 | 0.617 | 0.651 | 0.647 | 0.646 | 0.659 | 0.655 | 0.625 | 0.186 |
| Mn | 0.468 | 0.456 | 0.464 | 0.543 | 0.727 | 0.458 | 0.384 | 0.354 | 0.356 | 0.352 | 0.351 | 0.351 | 0.370 | 0.807 |
| Ti | 0.030 | 0.011 | 0.021 | 0.005 | 0.001 | 0.013 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 1.474 | 1.522 | 1.461 | 1.478 | 1.492 | 1.618 | 1.498 | 1.621 | 1.602 | 1.548 | 1.530 | 1.508 | 1.520 | 1.552 |
| Ta | 0.449 | 0.436 | 0.488 | 0.488 | 0.487 | 0.335 | 0.478 | 0.352 | 0.376 | 0.431 | 0.443 | 0.465 | 0.457 | 0.416 |
| Sn | 0.011 | 0.006 | 0.005 | 0.004 | 0.006 | 0.003 | 0.001 | 0.004 | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 |
| W | 0.027 | 0.003 | 0.008 | 0.008 | 0.010 | 0.012 | 0.010 | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.008 | 0.016 |
| Pb | 0.006 | 0.003 | 0.009 | 0.000 | 0.004 | 0.009 | 0.003 | 0.006 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.003 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.004 | 0.002 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.033 | 0.014 | 0.013 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| Ca | | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 |
| Total | 3.015 | 3.019 | 3.027 | 3.018 | 3.005 | 3.027 | 3.016 | 3.021 | 3.017 | 3.014 | 3.023 | 3.021 | 3.016 | 3.015 |
| Mn/(Mn+Fe) | 0.464 | 0.456 | 0.454 | 0.531 | 0.723 | 0.444 | 0.384 | 0.352 | 0.355 | 0.353 | 0.348 | 0.349 | 0.372 | 0.812 |
| Ta/(Ta+Nb) | 0.233 | 0.223 | 0.250 | 0.248 | 0.246 | 0.171 | 0.242 | 0.178 | 0.190 | 0.218 | 0.225 | 0.236 | 0.231 | 0.211 |
| Comments: | EK & EL same grain | | | EN & EO | | | | GB - GH same grain as EH & EI | | | | | | |
| | core | rim | | same grain | | | | rim | rim | rim | core | core | core | rim |
| | | | | | | | | | | | | | | odd comp |

## Columbite-Tantalite Group

| | **Big Whopper pegmatite** | | | | | | **Big Whopper pegmatite** | | | | | **SW Beryl pegmatite** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-29G | | | | | | 96-31 | | | | | 96053A | | |
| | GI | GJ | GK | GL | GM | GN | DA | DB | DC | BD | BE | SE | SJ | SK |
| FeO | 12.35 | 12.53 | 11.46 | 11.30 | 11.51 | 11.70 | 9.12 | 9.14 | 9.36 | 10.00 | 9.86 | 13.57 | 13.13 | 13.35 |
| MnO | 6.85 | 6.85 | 6.15 | 6.12 | 6.46 | 7.46 | 8.37 | 8.21 | 8.57 | 9.46 | 9.21 | 2.37 | 3.60 | 3.30 |
| TiO2 | | | | | | | 0.32 | 0.58 | 0.38 | 0.83 | 0.74 | 0.72 | 0.74 | 0.46 |
| Nb2O5 | 56.49 | 57.89 | 37.97 | 36.22 | 41.32 | 57.45 | 45.57 | 44.36 | 49.51 | 61.45 | 59.32 | 29.21 | 27.49 | 28.01 |
| Ta2O5 | 23.18 | 21.48 | 43.76 | 45.25 | 38.96 | 21.92 | 35.43 | 36.43 | 30.92 | 16.64 | 18.68 | 51.79 | 54.71 | 52.81 |
| SnO2 | 0.09 | 0.09 | 0.10 | 0.10 | 0.06 | 0.06 | 0.00 | 0.18 | 0.00 | 0.17 | 0.16 | 0.86 | 0.53 | 0.35 |
| WO3 | 0.42 | 0.43 | 0.42 | 0.41 | 0.41 | 0.50 | 0.43 | 0.00 | 0.52 | 0.69 | 0.56 | 0.17 | 0.14 | 0.14 |
| PbO | 0.27 | 0.28 | 0.20 | 0.16 | 0.23 | 0.22 | 0.16 | 0.31 | 0.00 | 0.35 | 0.37 | 0.07 | 0.08 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.08 | 0.00 | 0.05 | 0.00 | 0.04 | 0.00 | 0.00 | 0.30 | 0.08 | 0.10 | 0.11 | 0.00 | 0.07 |
| CaO | 0.00 | 0.01 | 0.02 | 0.02 | 0.00 | 0.03 | | | | | | 0.01 | 0.03 | 0.02 |
| Total | 99.89 | 99.90 | 100.35 | 99.91 | 99.29 | 99.67 | 99.44 | 99.22 | 99.71 | 99.67 | 99.02 | 98.88 | 100.41 | 98.62 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.642 | 0.646 | 0.651 | 0.650 | 0.647 | 0.605 | 0.502 | 0.506 | 0.502 | 0.505 | 0.506 | 0.814 | 0.784 | 0.809 |
| Mn | 0.360 | 0.358 | 0.354 | 0.357 | 0.368 | 0.391 | 0.466 | 0.460 | 0.466 | 0.484 | 0.479 | 0.144 | 0.218 | 0.203 |
| Ti | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.016 | 0.029 | 0.018 | 0.038 | 0.034 | 0.039 | 0.040 | 0.025 |
| Nb | 1.587 | 1.614 | 1.166 | 1.126 | 1.256 | 1.607 | 1.355 | 1.328 | 1.436 | 1.679 | 1.647 | 0.947 | 0.888 | 0.918 |
| Ta | 0.392 | 0.360 | 0.808 | 0.846 | 0.713 | 0.369 | 0.634 | 0.656 | 0.539 | 0.274 | 0.312 | 1.010 | 1.063 | 1.041 |
| Sn | 0.002 | 0.002 | 0.003 | 0.003 | 0.002 | 0.001 | 0.000 | 0.005 | 0.000 | 0.004 | 0.004 | 0.024 | 0.015 | 0.010 |
| W | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 | 0.008 | 0.007 | 0.000 | 0.009 | 0.011 | 0.009 | 0.003 | 0.003 | 0.003 |
| Pb | 0.005 | 0.005 | 0.004 | 0.003 | 0.004 | 0.004 | 0.003 | 0.006 | 0.000 | 0.006 | 0.006 | 0.001 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.004 | 0.000 | 0.003 | 0.000 | 0.002 | 0.000 | 0.000 | 0.017 | 0.004 | 0.005 | 0.007 | 0.000 | 0.004 |
| Ca | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.002 | | | | | | 0.001 | 0.002 | 0.002 |
| Total | 3.016 | 3.020 | 3.021 | 3.023 | 3.031 | 3.017 | 2.985 | 2.990 | 2.991 | 3.005 | 3.003 | 2.991 | 3.014 | 3.018 |
| Mn/(Mn+Fe) | 0.360 | 0.356 | 0.352 | 0.354 | 0.362 | 0.392 | 0.482 | 0.476 | 0.481 | 0.489 | 0.486 | 0.150 | 0.217 | 0.200 |
| Ta/(Ta+Nb) | 0.198 | 0.183 | 0.409 | 0.429 | 0.362 | 0.187 | 0.319 | 0.331 | 0.273 | 0.140 | 0.159 | 0.516 | 0.545 | 0.531 |
| Comments: | | | | | | | | | | | | SJ & SK same grain incls. in cassiterite | | |

**SW Beryl pegmatite**

96-53B

| | JA | JB | JC | JD | JE | JF | JG | JH | JI | JJ | JK | JL | JM | JN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 15.17 | 13.73 | 13.31 | 11.16 | 14.39 | 11.73 | 10.77 | 10.87 | 11.19 | 12.06 | 12.66 | 12.66 | 10.86 | 10.81 |
| MnO | 4.35 | 4.80 | 4.25 | 6.34 | 4.83 | 3.92 | 4.23 | 4.12 | 4.56 | 4.18 | 5.12 | 4.82 | 5.20 | 5.11 |
| TiO2 | 0.65 | 1.08 | 0.19 | 0.13 | 0.76 | 0.26 | 0.15 | 0.15 | 0.37 | 0.38 | 0.34 | 0.19 | 0.07 | 0.01 |
| Nb2O5 | 62.18 | 50.98 | 40.74 | 37.48 | 60.30 | 22.36 | 17.28 | 17.61 | 22.47 | 30.13 | 41.53 | 37.96 | 25.96 | 25.56 |
| Ta2O5 | 16.80 | 28.29 | 41.05 | 44.00 | 19.58 | 60.75 | 66.79 | 66.48 | 60.76 | 51.39 | 39.70 | 43.78 | 57.42 | 57.53 |
| SnO2 | 0.00 | 0.23 | 0.09 | 0.00 | 0.03 | 0.07 | 0.09 | 0.24 | 0.36 | 0.35 | 0.00 | 0.06 | 0.13 | 0.00 |
| WO3 | 0.62 | 0.62 | 0.26 | 0.47 | 0.48 | 0.47 | 0.45 | 0.08 | 0.37 | 0.01 | 0.14 | 0.09 | 0.18 | 0.36 |
| PbO | 0.70 | 0.00 | 0.64 | 0.31 | 0.23 | 0.51 | 0.03 | 0.02 | 0.00 | 0.42 | 0.32 | 0.32 | 0.07 | 0.00 |
| ThO2 | 0.15 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.00 | 0.08 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.09 | 0.30 | 0.52 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.63 | 0.00 | 0.00 | 0.00 | 0.03 |
| Sb2O3 | 0.04 | 0.16 | 0.01 | 0.16 | 0.15 | 0.12 | 0.00 | 0.21 | 0.00 | 0.00 | 0.00 | 0.05 | 0.14 | 0.00 |
| Bi2O3 | 0.00 | 0.10 | 0.08 | 0.00 | 0.10 | 0.00 | 0.00 | 0.38 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.68 | 0.00 | 0.31 | 0.00 | 0.52 | 0.00 | 0.08 | 0.13 | 0.00 | 0.00 | 0.00 | 0.02 | 0.79 |
| CaO | | | | | | | | | | | | | | |
| Total | 100.65 | 100.77 | 100.92 | 101.07 | 100.85 | 100.71 | 99.79 | 100.29 | 100.20 | 99.84 | 99.85 | 99.99 | 100.04 | 100.20 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.763 | 0.719 | 0.745 | 0.633 | 0.727 | 0.723 | 0.692 | 0.694 | 0.691 | 0.720 | 0.709 | 0.723 | 0.662 | 0.656 |
| Mn | 0.222 | 0.255 | 0.241 | 0.364 | 0.247 | 0.24 | 0.275 | 0.267 | 0.285 | 0.253 | 0.290 | 0.279 | 0.321 | 0.314 |
| Ti | 0.029 | 0.051 | 0.010 | 0.007 | 0.035 | 0.014 | 0.008 | 0.008 | 0.020 | 0.020 | 0.017 | 0.010 | 0.004 | 0.001 |
| Nb | 1.690 | 1.444 | 1.233 | 1.150 | 1.647 | 0.745 | 0.599 | 0.608 | 0.750 | 0.973 | 1.258 | 1.172 | 0.855 | 0.838 |
| Ta | 0.275 | 0.482 | 0.748 | 0.812 | 0.322 | 1.218 | 1.394 | 1.381 | 1.221 | 0.998 | 0.723 | 0.813 | 1.138 | 1.135 |
| Sn | 0.000 | 0.006 | 0.003 | 0.000 | 0.001 | 0.002 | 0.003 | 0.007 | 0.011 | 0.010 | 0.000 | 0.002 | 0.004 | 0.000 |
| W | 0.010 | 0.010 | 0.005 | 0.008 | 0.008 | 0.009 | 0.009 | 0.002 | 0.007 | 0.000 | 0.002 | 0.002 | 0.003 | 0.007 |
| Pb | 0.011 | 0.000 | 0.012 | 0.006 | 0.004 | 0.010 | 0.001 | 0.000 | 0.000 | 0.008 | 0.006 | 0.006 | 0.001 | 0.000 |
| Th | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.001 | 0.000 | 0.000 |
| U | 0.000 | 0.001 | 0.004 | 0.008 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.004 | 0.000 | 0.005 | 0.004 | 0.004 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.000 |
| Bi | 0.000 | 0.002 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.037 | 0.000 | 0.019 | 0.000 | 0.033 | 0.000 | 0.005 | 0.008 | 0.000 | 0.000 | 0.000 | 0.001 | 0.050 |
| Ca | | | | | | | | | | | | | | |
| Total | 3.002 | 3.011 | 3.002 | 3.013 | 2.994 | 3.003 | 2.981 | 2.988 | 2.994 | 2.998 | 3.006 | 3.007 | 2.993 | 3.001 |
| Mn/(Mn+Fe) | 0.225 | 0.262 | 0.244 | 0.365 | 0.254 | 0.253 | 0.284 | 0.278 | 0.292 | 0.260 | 0.290 | 0.278 | 0.327 | 0.324 |
| Ta/(Ta+Nb) | 0.140 | 0.250 | 0.377 | 0.414 | 0.163 | 0.620 | 0.699 | 0.694 | 0.619 | 0.506 | 0.365 | 0.410 | 0.571 | 0.575 |

Comments: JA - JD same grain JE - JG same grain JH - JN same grain

| primary | secondary | primary | secondary |
|---|---|---|---|

## Columbite-Tantalite Group

| | SW Beryl pegmatite | | | Pegmatite 14 | | S. R. pluton | | SW Beryl pegmatite | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-55 | | | 96-57B | | 96-72B | | 96-76 | | | |
| | MN | MO | CB | LI | LJ | KJ | KK | MG | MK | ML | MS |
| FeO | 15.75 | 15.68 | 15.84 | 12.66 | 11.83 | 16.97 | 17.20 | 12.29 | 12.66 | 12.33 | 11.16 |
| MnO | 3.93 | 3.97 | 3.87 | 5.08 | 5.36 | 1.71 | 1.65 | 5.77 | 6.29 | 6.83 | 5.50 |
| TiO2 | 0.43 | 0.34 | 0.40 | 1.68 | 1.58 | 0.84 | 1.12 | 0.63 | 0.70 | 0.61 | 0.20 |
| Nb2O5 | 63.00 | 61.87 | 60.73 | 45.87 | 40.04 | 50.00 | 52.27 | 48.92 | 58.60 | 58.23 | 36.02 |
| Ta2O5 | 16.27 | 17.75 | 18.62 | 32.37 | 39.76 | 27.51 | 25.66 | 30.51 | 19.61 | 19.93 | 45.51 |
| SnO2 | 0.14 | 0.00 | 0.11 | 0.48 | 0.57 | 0.43 | 0.18 | 0.17 | 0.18 | 0.16 | 0.10 |
| WO3 | 0.28 | 0.50 | 0.17 | 0.62 | 0.75 | 2.00 | 1.55 | 0.39 | 0.74 | 0.65 | 0.28 |
| PbO | 0.65 | 0.30 | 0.00 | 0.30 | 0.31 | 0.22 | 0.24 | 0.17 | 0.27 | 0.32 | 0.15 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.23 | 0.22 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.19 | 0.00 | 0.41 | 0.56 | 0.60 | 0.11 | 0.15 | 0.00 | 0.20 | 0.18 | 0.02 |
| CaO | | | | | | 0.03 | 0.01 | 0.00 | 0.00 | 0.02 | 0.03 |
| Total | 100.65 | 100.41 | 100.41 | 100.37 | 100.78 | 99.83 | 100.03 | 98.84 | 99.25 | 99.24 | 98.99 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.789 | 0.791 | 0.800 | 0.681 | 0.652 | 0.903 | 0.903 | 0.666 | 0.651 | 0.635 | 0.648 |
| Mn | 0.199 | 0.203 | 0.198 | 0.277 | 0.299 | 0.092 | 0.088 | 0.317 | 0.328 | 0.357 | 0.324 |
| Ti | 0.019 | 0.016 | 0.018 | 0.081 | 0.078 | 0.040 | 0.053 | 0.031 | 0.032 | 0.028 | 0.011 |
| Nb | 1.706 | 1.687 | 1.659 | 1.334 | 1.194 | 1.439 | 1.483 | 1.433 | 1.629 | 1.623 | 1.132 |
| Ta | 0.265 | 0.291 | 0.306 | 0.566 | 0.713 | 0.476 | 0.438 | 0.537 | 0.328 | 0.334 | 0.860 |
| Sn | 0.003 | 0.000 | 0.003 | 0.012 | 0.015 | 0.011 | 0.005 | 0.004 | 0.004 | 0.004 | 0.003 |
| W | 0.004 | 0.008 | 0.003 | 0.010 | 0.013 | 0.033 | 0.025 | 0.007 | 0.012 | 0.010 | 0.005 |
| Pb | 0.010 | 0.005 | 0.000 | 0.005 | 0.006 | 0.004 | 0.004 | 0.003 | 0.004 | 0.005 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.003 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.010 | 0.000 | 0.022 | 0.032 | 0.034 | 0.006 | 0.008 | 0.000 | 0.011 | 0.009 | 0.001 |
| Ca | | | | | | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 |
| Total | 3.007 | 3.001 | 3.012 | 3.011 | 3.004 | 3.007 | 3.007 | 2.997 | 2.999 | 3.007 | 2.988 |
| Mn/(Mn+Fe) | 0.202 | 0.204 | 0.198 | 0.289 | 0.315 | 0.092 | 0.088 | 0.322 | 0.335 | 0.360 | 0.333 |
| Ta/(Ta+Nb) | 0.134 | 0.147 | 0.156 | 0.298 | 0.374 | 0.249 | 0.228 | 0.273 | 0.168 | 0.171 | 0.432 |
| Comments: | MN & MO<br>same grain | | | | | KJ & KK<br>same grain | | | | | |

| | SW Beryl pegmatite | | | | | | | | | | SW Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-76A | | | | | | | | | | 96-81 | | | | |
| | TB | TC | TD | TE | TF | TG | TH | TJ | TN | TO | NA | NB | NC | ND | NM |
| FeO | 11.15 | 11.48 | 11.29 | 11.69 | 11.40 | 11.44 | 11.13 | 11.49 | 11.07 | 11.38 | 13.66 | 13.49 | 13.59 | 13.75 | 13.27 |
| MnO | 5.32 | 5.40 | 5.46 | 5.66 | 5.56 | 5.49 | 5.33 | 5.60 | 5.72 | 5.36 | 1.57 | 1.58 | 1.63 | 1.59 | 1.52 |
| TiO2 | 0.17 | 0.22 | 0.18 | 0.34 | 0.22 | 0.30 | 0.17 | 0.13 | 0.04 | 0.42 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nb2O5 | 35.12 | 39.16 | 39.37 | 42.24 | 40.52 | 40.57 | 34.99 | 39.98 | 37.64 | 37.77 | 26.64 | 25.17 | 25.34 | 27.04 | 22.16 |
| Ta2O5 | 46.79 | 42.83 | 42.36 | 38.52 | 40.60 | 40.14 | 46.97 | 42.19 | 44.26 | 43.58 | 57.30 | 58.18 | 58.00 | 57.05 | 61.12 |
| SnO2 | 0.21 | 0.15 | 0.19 | 0.19 | 0.59 | 0.72 | 0.37 | 0.12 | 0.13 | 0.23 | 0.00 | 0.09 | 0.00 | 0.21 | 0.34 |
| WO3 | 0.23 | 0.22 | 0.16 | 0.33 | 0.29 | 0.19 | 0.20 | 0.15 | 0.19 | 0.23 | 0.25 | 0.43 | 0.18 | 0.36 | 0.01 |
| PbO | 0.19 | 0.13 | 0.17 | 0.16 | 0.23 | 0.21 | 0.15 | 0.21 | 0.16 | 0.24 | 0.07 | 0.45 | 0.00 | 0.00 | 0.61 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.47 | 0.00 | 0.40 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.49 | 0.00 | 0.00 | 0.17 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.19 | 0.18 | 0.58 |
| Sc2O3 | 0.00 | 0.11 | 0.05 | 0.00 | 0.02 | 0.10 | 0.08 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.69 | 0.00 | 0.00 |
| CaO | 0.02 | 0.01 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.01 | 0.01 | 0.00 | | | | | |
| Total | 99.19 | 99.69 | 99.25 | 99.16 | 99.50 | 99.25 | 99.41 | 99.91 | 99.23 | 99.20 | 99.87 | 99.90 | 100.10 | 100.18 | 100.18 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.650 | 0.652 | 0.643 | 0.656 | 0.644 | 0.646 | 0.648 | 0.650 | 0.637 | 0.653 | 0.833 | 0.832 | 0.830 | 0.834 | 0.834 |
| Mn | 0.314 | 0.310 | 0.315 | 0.321 | 0.318 | 0.314 | 0.314 | 0.321 | 0.334 | 0.311 | 0.097 | 0.098 | 0.101 | 0.098 | 0.097 |
| Ti | 0.009 | 0.011 | 0.009 | 0.017 | 0.011 | 0.015 | 0.009 | 0.007 | 0.002 | 0.022 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 1.108 | 1.202 | 1.213 | 1.280 | 1.238 | 1.240 | 1.101 | 1.222 | 1.172 | 1.172 | 0.879 | 0.839 | 0.837 | 0.887 | 0.752 |
| Ta | 0.888 | 0.791 | 0.785 | 0.702 | 0.746 | 0.738 | 0.889 | 0.776 | 0.829 | 0.813 | 1.137 | 1.167 | 1.152 | 1.125 | 1.248 |
| Sn | 0.006 | 0.004 | 0.005 | 0.005 | 0.016 | 0.019 | 0.010 | 0.003 | 0.004 | 0.006 | 0.000 | 0.003 | 0.000 | 0.006 | 0.010 |
| W | 0.004 | 0.004 | 0.003 | 0.006 | 0.005 | 0.003 | 0.004 | 0.003 | 0.003 | 0.004 | 0.005 | 0.008 | 0.003 | 0.007 | 0.000 |
| Pb | 0.003 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.001 | 0.009 | 0.000 | 0.000 | 0.012 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.007 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.008 | 0.000 | 0.000 | 0.003 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.003 | 0.011 |
| Sc | 0.000 | 0.007 | 0.003 | 0.000 | 0.001 | 0.006 | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.044 | 0.000 | 0.000 |
| Ca | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 | 0.001 | 0.000 | | | | | |
| Total | 2.984 | 2.984 | 2.982 | 2.992 | 2.986 | 2.989 | 2.985 | 2.987 | 2.986 | 2.986 | 2.960 | 2.964 | 2.978 | 2.960 | 2.974 |
| Mn/(Mn+Fe) | 0.326 | 0.323 | 0.329 | 0.329 | 0.330 | 0.327 | 0.327 | 0.331 | 0.344 | 0.323 | 0.104 | 0.106 | 0.108 | 0.105 | 0.104 |
| Ta/(Ta+Nb) | 0.445 | 0.397 | 0.393 | 0.354 | 0.376 | 0.373 | 0.447 | 0.388 | 0.414 | 0.410 | 0.564 | 0.582 | 0.579 | 0.559 | 0.624 |
| Comments: | | TC - TE<br>same grain | | | TF & TG<br>same grain | | | | | | NA - ND same cluster<br>assoc. with later tapiolite NE - NH<br>odd structural formulae | | | | |

| | SW Beryl pegmatite | | | | | | SW Beryl pegmatite | | | East Beryl peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-81 | | | | | | 96-81X | | | 96-82A | |
| | NR | NS | NT | GK | GL | GM | GA | GB | GC | CA | CB |
| FeO | 13.30 | 12.96 | 13.07 | 13.75 | 13.94 | 13.42 | 13.22 | 13.49 | 13.81 | 10.30 | 10.46 |
| MnO | 1.75 | 1.69 | 1.74 | 1.48 | 0.98 | 1.09 | 0.69 | 0.73 | 0.78 | 6.29 | 5.89 |
| TiO2 | 0.07 | 0.11 | 0.00 | 0.40 | 0.76 | 0.66 | 0.25 | 0.34 | 0.53 | 0.18 | 0.21 |
| Nb2O5 | 22.68 | 18.97 | 21.68 | 26.72 | 18.64 | 18.98 | 26.18 | 25.84 | 30.23 | 30.98 | 28.76 |
| Ta2O5 | 61.64 | 64.71 | 63.10 | 56.36 | 65.74 | 63.42 | 58.67 | 57.03 | 53.39 | 50.92 | 53.56 |
| SnO2 | 0.08 | 0.56 | 0.02 | 0.05 | 0.32 | 0.31 | 0.03 | 1.11 | 0.20 | 0.03 | 0.00 |
| WO3 | 0.00 | 0.60 | 0.26 | 0.25 | 0.28 | 0.27 | 0.42 | 0.80 | 0.24 | 0.37 | 0.40 |
| PbO | 0.27 | 0.28 | 0.01 | 0.12 | 0.05 | 0.06 | 0.05 | 0.11 | 0.09 | 0.00 | 0.50 |
| ThO2 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| Sb2O3 | 0.25 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.12 |
| Bi2O3 | 0.19 | 0.44 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.65 | 0.00 | 0.02 | 0.13 | 0.00 | 0.00 | 0.11 | 0.00 | 0.09 |
| CaO | | | | 0.01 | 0.00 | 0.03 | 0.03 | 0.02 | 0.02 | | |
| Total | 100.23 | 100.52 | 100.63 | 99.14 | 100.72 | 98.39 | 99.53 | 99.47 | 99.40 | 99.28 | 99.99 |
| | | | | | | | | | | | |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.828 | 0.822 | 0.810 | 0.840 | 0.876 | 0.859 | 0.810 | 0.826 | 0.825 | 0.614 | 0.628 |
| Mn | 0.110 | 0.109 | 0.109 | 0.092 | 0.062 | 0.071 | 0.043 | 0.045 | 0.047 | 0.379 | 0.358 |
| Ti | 0.004 | 0.006 | 0.000 | 0.022 | 0.043 | 0.038 | 0.014 | 0.019 | 0.028 | 0.010 | 0.011 |
| Nb | 0.763 | 0.650 | 0.727 | 0.882 | 0.633 | 0.657 | 0.867 | 0.855 | 0.976 | 0.997 | 0.933 |
| Ta | 1.248 | 1.334 | 1.272 | 1.120 | 1.343 | 1.320 | 1.169 | 1.135 | 1.037 | 0.986 | 1.045 |
| Sn | 0.002 | 0.017 | 0.001 | 0.001 | 0.010 | 0.010 | 0.001 | 0.032 | 0.006 | 0.001 | 0.000 |
| W | 0.000 | 0.012 | 0.005 | 0.005 | 0.005 | 0.005 | 0.008 | 0.015 | 0.004 | 0.007 | 0.007 |
| Pb | 0.005 | 0.006 | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.000 | 0.010 |
| Th | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Sb | 0.008 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 |
| Bi | 0.004 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.042 | 0.000 | 0.001 | 0.009 | 0.000 | 0.000 | 0.007 | 0.000 | 0.006 |
| Ca | | | | 0.001 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 | | |
| Total | 2.972 | 2.970 | 2.968 | 2.965 | 2.973 | 2.972 | 2.915 | 2.932 | 2.934 | 2.998 | 3.002 |
| | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.118 | 0.117 | 0.119 | 0.098 | 0.067 | 0.076 | 0.050 | 0.052 | 0.054 | 0.382 | 0.363 |
| Ta/(Ta+Nb) | 0.621 | 0.672 | 0.636 | 0.559 | 0.680 | 0.668 | 0.574 | 0.570 | 0.515 | 0.497 | 0.528 |
| | | | | | | | | | | | |
| Comments: | | NS & NT<br>same grain<br>mantled by ferrotapiolite NU & NV | | GK - GM<br>same grain | | | | | | CA & CB<br>same grain | |

| | East Beryl pegmatite | | | | | | | SW Beryl peg. | | SW Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-82B | | | | | | | 96-85 | | 96-86 | | | | |
| | MA | MB | MC | MD | ME | MF | MG | GC | GD | FL | QF | AC | AD | AE |
| FeO | 13.77 | 13.96 | 13.83 | 13.88 | 13.77 | 12.64 | 11.76 | 17.60 | 17.80 | 9.46 | 10.00 | 10.54 | 10.28 | 9.27 |
| MnO | 4.32 | 4.30 | 4.29 | 4.41 | 4.37 | 4.35 | 4.27 | 2.70 | 2.84 | 7.12 | 7.67 | 7.13 | 7.21 | 6.41 |
| TiO2 | 0.52 | 0.57 | 0.58 | 0.61 | 0.63 | 0.52 | 0.65 | 0.63 | 0.64 | 0.43 | 0.39 | 1.27 | 1.03 | 1.07 |
| Nb2O5 | 48.08 | 49.34 | 47.90 | 49.65 | 48.61 | 36.39 | 28.05 | 67.20 | 67.92 | 44.48 | 44.45 | 48.07 | 45.23 | 25.48 |
| Ta2O5 | 32.01 | 30.71 | 32.53 | 29.81 | 31.66 | 45.59 | 55.02 | 9.96 | 9.78 | 35.26 | 35.80 | 31.14 | 35.41 | 56.37 |
| SnO2 | 0.08 | 0.11 | 0.08 | 0.08 | 0.08 | 0.13 | 0.21 | 0.03 | 0.25 | 0.19 | 0.14 | 0.33 | 0.30 | 0.36 |
| WO3 | 0.59 | 0.72 | 0.57 | 1.04 | 0.94 | 0.54 | 0.56 | 0.73 | 0.36 | 0.59 | 0.60 | 0.76 | 0.74 | 0.72 |
| PbO | 0.15 | 0.19 | 0.24 | 0.23 | 0.22 | 0.15 | 0.02 | 0.15 | 0.23 | 0.39 | 0.12 | 0.25 | 0.24 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.26 | 0.12 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 |
| Sc2O3 | 0.01 | 0.03 | 0.03 | 0.00 | 0.13 | 0.06 | 0.14 | 0.34 | 0.20 | 0.00 | 0.04 | 0.10 | 0.14 | 0.07 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | | | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 99.55 | 99.93 | 100.06 | 99.71 | 100.39 | 100.37 | 100.68 | 99.97 | 100.14 | 98.11 | 99.21 | 99.60 | 100.59 | 99.87 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.746 | 0.749 | 0.747 | 0.744 | 0.738 | 0.722 | 0.700 | 0.865 | 0.871 | 0.529 | 0.553 | 0.567 | 0.557 | 0.561 |
| Mn | 0.237 | 0.234 | 0.235 | 0.239 | 0.237 | 0.252 | 0.257 | 0.135 | 0.141 | 0.404 | 0.430 | 0.388 | 0.396 | 0.393 |
| Ti | 0.025 | 0.027 | 0.028 | 0.030 | 0.030 | 0.027 | 0.035 | 0.028 | 0.028 | 0.022 | 0.020 | 0.061 | 0.050 | 0.058 |
| Nb | 1.408 | 1.431 | 1.398 | 1.439 | 1.408 | 1.124 | 0.902 | 1.786 | 1.797 | 1.346 | 1.329 | 1.397 | 1.326 | 0.834 |
| Ta | 0.564 | 0.536 | 0.571 | 0.520 | 0.552 | 0.847 | 1.065 | 0.159 | 0.156 | 0.642 | 0.644 | 0.544 | 0.625 | 1.110 |
| Sn | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.004 | 0.006 | 0.001 | 0.006 | 0.005 | 0.004 | 0.008 | 0.008 | 0.010 |
| W | 0.010 | 0.012 | 0.010 | 0.017 | 0.016 | 0.010 | 0.010 | 0.011 | 0.005 | 0.010 | 0.010 | 0.013 | 0.012 | 0.013 |
| Pb | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.003 | 0.000 | 0.002 | 0.004 | 0.007 | 0.002 | 0.004 | 0.004 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.001 | 0.002 | 0.002 | 0.000 | 0.007 | 0.003 | 0.009 | 0.017 | 0.010 | 0.000 | 0.002 | 0.005 | 0.008 | 0.005 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | | | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.995 | 2.996 | 2.996 | 2.996 | 2.994 | 2.992 | 2.984 | 3.015 | 3.020 | 2.969 | 2.995 | 2.990 | 2.987 | 2.987 |
| Mn/(Mn+Fe) | 0.241 | 0.238 | 0.239 | 0.243 | 0.243 | 0.259 | 0.269 | 0.135 | 0.139 | 0.433 | 0.437 | 0.407 | 0.416 | 0.412 |
| Ta/(Ta+Nb) | 0.286 | 0.272 | 0.290 | 0.265 | 0.281 | 0.430 | 0.541 | 0.082 | 0.080 | 0.323 | 0.326 | 0.280 | 0.320 | 0.571 |
| Comments: | all from same large grain | | | MB - MG traverse from core to thin rim region (F & G) | | | | | | inclusion in gnt. | | | | |

**SW Beryl pegmatite**

**96-86A**

| | HA | HB | HC | HD | HE | HF | HG | HH | HI | HJ | LA2 | LA3 | LA4 | LA5 | LA6 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.77 | 2.71 | 2.66 | 2.67 | 3.24 | 2.71 | 2.74 | 4.43 | 2.77 | 4.64 | 3.02 | 2.64 | 2.52 | 2.45 | 2.59 |
| MnO | 14.66 | 14.68 | 14.70 | 14.55 | 14.13 | 13.67 | 13.71 | 12.72 | 13.72 | 13.23 | 12.83 | 13.50 | 13.40 | 13.66 | 13.59 |
| TiO2 | 0.17 | 0.21 | 0.10 | 0.22 | 0.21 | 0.01 | 0.33 | 0.33 | 0.21 | 0.30 | 0.36 | 0.29 | 0.29 | 0.40 | 0.30 |
| Nb2O5 | 35.95 | 36.43 | 37.22 | 36.73 | 37.72 | 28.83 | 28.77 | 39.10 | 28.19 | 39.25 | 27.00 | 29.76 | 28.21 | 30.25 | 28.62 |
| Ta2O5 | 45.19 | 45.02 | 43.90 | 44.30 | 42.16 | 53.16 | 53.65 | 41.25 | 53.30 | 41.34 | 55.11 | 53.16 | 54.38 | 51.87 | 53.29 |
| SnO2 | 0.19 | 0.29 | 0.29 | 0.00 | 0.20 | 0.10 | 0.32 | 0.20 | 0.31 | 0.00 | 0.30 | 0.17 | 0.16 | 0.18 | 0.12 |
| WO3 | 0.37 | 0.66 | 0.54 | 0.85 | 1.01 | 0.49 | 0.69 | 0.72 | 0.98 | 0.61 | 0.58 | 0.60 | 0.77 | 0.94 | 0.72 |
| PbO | 0.16 | 0.40 | 0.00 | 0.19 | 0.00 | 0.36 | 0.00 | 0.43 | 0.34 | 0.18 | 0.01 | 0.14 | 0.17 | 0.08 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.03 | 0.20 | 0.00 | 0.21 | 0.00 | 0.01 | 0.04 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.17 | 0.22 | 0.28 | 0.05 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.23 | 0.00 | 0.54 | 0.10 | 0.50 | 0.28 | 0.20 | 0.57 | 0.49 | 0.17 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.49 | 0.00 | 0.47 | 0.00 | 0.00 | 0.08 | 0.09 | 0.00 | 0.00 | 0.04 |
| CaO | | | | | | | | | | | 0.00 | 0.02 | 0.01 | 0.01 | 0.01 |
| Total | 99.67 | 100.40 | 100.03 | 99.83 | 99.37 | 100.48 | 100.65 | 100.52 | 100.39 | 100.09 | 99.28 | 100.35 | 99.96 | 99.83 | 99.35 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.160 | 0.155 | 0.152 | 0.154 | 0.186 | 0.162 | 0.163 | 0.250 | 0.166 | 0.262 | 0.183 | 0.156 | 0.151 | 0.145 | 0.156 |
| Mn | 0.857 | 0.851 | 0.852 | 0.847 | 0.820 | 0.826 | 0.826 | 0.726 | 0.833 | 0.757 | 0.788 | 0.811 | 0.815 | 0.821 | 0.828 |
| Ti | 0.009 | 0.011 | 0.005 | 0.012 | 0.011 | 0.000 | 0.018 | 0.017 | 0.011 | 0.015 | 0.019 | 0.015 | 0.016 | 0.021 | 0.016 |
| Nb | 1.122 | 1.127 | 1.152 | 1.140 | 1.169 | 0.930 | 0.924 | 1.191 | 0.914 | 1.199 | 0.886 | 0.954 | 0.916 | 0.970 | 0.930 |
| Ta | 0.848 | 0.838 | 0.817 | 0.827 | 0.786 | 1.032 | 1.037 | 0.756 | 1.039 | 0.760 | 1.087 | 1.025 | 1.062 | 1.001 | 1.042 |
| Sn | 0.005 | 0.008 | 0.008 | 0.000 | 0.005 | 0.003 | 0.009 | 0.005 | 0.009 | 0.000 | 0.009 | 0.005 | 0.004 | 0.005 | 0.003 |
| W | 0.007 | 0.012 | 0.010 | 0.015 | 0.018 | 0.009 | 0.013 | 0.013 | 0.018 | 0.011 | 0.011 | 0.011 | 0.014 | 0.017 | 0.013 |
| Pb | 0.003 | 0.007 | 0.000 | 0.004 | 0.000 | 0.007 | 0.000 | 0.008 | 0.007 | 0.003 | 0.000 | 0.003 | 0.003 | 0.001 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.005 | 0.006 | 0.008 | 0.001 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.004 | 0.000 | 0.010 | 0.002 | 0.009 | 0.005 | 0.004 | 0.010 | 0.009 | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.030 | 0.000 | 0.028 | 0.000 | 0.000 | 0.005 | 0.006 | 0.000 | 0.000 | 0.002 |
| Ca | | | | | | | | | | | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 |
| Total | 3.015 | 3.010 | 3.008 | 3.003 | 3.009 | 3.013 | 3.000 | 3.010 | 3.008 | 3.018 | 2.988 | 2.987 | 2.984 | 2.983 | 2.994 |
| Mn/(Mn+Fe) | 0.843 | 0.846 | 0.849 | 0.847 | 0.815 | 0.837 | 0.835 | 0.744 | 0.834 | 0.743 | 0.811 | 0.838 | 0.843 | 0.850 | 0.842 |
| Ta/(Ta+Nb) | 0.431 | 0.426 | 0.415 | 0.420 | 0.402 | 0.526 | 0.529 | 0.388 | 0.532 | 0.388 | 0.551 | 0.518 | 0.537 | 0.508 | 0.528 |
| Comments: | HA & HB same grain | | | | | HF - HH same grain | | | HI & HJ | | | | grain 1 | | |
| | HA - HE homogeneous | | | | | lighter BSE | | dark | same grain | | | | all unzoned | | |
| | | | | | | | | patchy | lighter BSE | | | | | | |

| | SW Beryl pegmatite<br>96-86A | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LA7 | LA8 | LA9 | LA10 | LA11 | LA12 | LA13 | LA14 | LA15 | LA16 | LA17 | LA18 | LA19 | LA20 | LA21 |
| FeO | 2.53 | 2.57 | 2.61 | 2.55 | 2.53 | 2.43 | 2.55 | 2.59 | 2.59 | 2.57 | 2.59 | 3.31 | 3.10 | 3.41 | 3.07 |
| MnO | 13.42 | 13.37 | 13.61 | 13.41 | 13.46 | 13.65 | 13.43 | 13.48 | 13.42 | 13.47 | 13.08 | 12.70 | 12.87 | 12.74 | 13.09 |
| TiO2 | 0.27 | 0.29 | 0.25 | 0.27 | 0.28 | 0.31 | 0.24 | 0.24 | 0.24 | 0.23 | 0.24 | 0.28 | 0.22 | 0.24 | 0.24 |
| Nb2O5 | 28.25 | 28.29 | 28.27 | 28.38 | 28.47 | 28.38 | 28.52 | 28.62 | 28.20 | 28.67 | 28.39 | 28.54 | 28.78 | 28.32 | 28.64 |
| Ta2O5 | 54.15 | 53.70 | 53.66 | 53.98 | 53.80 | 53.99 | 53.96 | 53.80 | 53.92 | 54.28 | 53.66 | 54.05 | 54.11 | 54.08 | 54.39 |
| SnO2 | 0.15 | 0.19 | 0.17 | 0.21 | 0.18 | 0.13 | 0.14 | 0.13 | 0.11 | 0.16 | 0.15 | 0.16 | 0.19 | 0.18 | 0.15 |
| WO3 | 0.74 | 0.78 | 0.75 | 0.78 | 0.79 | 0.71 | 0.68 | 0.76 | 0.66 | 0.63 | 0.71 | 0.78 | 0.62 | 0.71 | 0.70 |
| PbO | 0.15 | 0.09 | 0.07 | 0.22 | 0.12 | 0.13 | 0.13 | 0.12 | 0.15 | 0.06 | 0.10 | 0.11 | 0.09 | 0.16 | 0.09 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.06 | 0.06 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.05 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.09 | 0.04 | 0.11 | 0.04 | 0.00 | 0.00 | 0.08 | 0.02 |
| CaO | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.04 | 0.02 | 0.02 | 0.02 | 0.00 | 0.13 | 0.01 | 0.02 | 0.00 | 0.01 |
| Total | 99.66 | 99.33 | 99.48 | 99.80 | 99.64 | 99.77 | 99.68 | 99.85 | 99.34 | 100.17 | 99.23 | 100.00 | 100.04 | 99.92 | 100.40 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.152 | 0.155 | 0.157 | 0.153 | 0.152 | 0.146 | 0.153 | 0.155 | 0.156 | 0.153 | 0.157 | 0.198 | 0.186 | 0.205 | 0.183 |
| Mn | 0.818 | 0.816 | 0.830 | 0.816 | 0.820 | 0.830 | 0.818 | 0.818 | 0.820 | 0.815 | 0.800 | 0.771 | 0.780 | 0.774 | 0.791 |
| Ti | 0.015 | 0.015 | 0.014 | 0.014 | 0.015 | 0.017 | 0.013 | 0.013 | 0.013 | 0.012 | 0.013 | 0.015 | 0.012 | 0.013 | 0.013 |
| Nb | 0.919 | 0.922 | 0.920 | 0.922 | 0.925 | 0.921 | 0.926 | 0.927 | 0.920 | 0.926 | 0.926 | 0.924 | 0.931 | 0.919 | 0.924 |
| Ta | 1.060 | 1.053 | 1.051 | 1.055 | 1.051 | 1.054 | 1.055 | 1.048 | 1.058 | 1.055 | 1.053 | 1.053 | 1.053 | 1.055 | 1.055 |
| Sn | 0.004 | 0.005 | 0.005 | 0.006 | 0.005 | 0.004 | 0.004 | 0.004 | 0.003 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.004 |
| W | 0.014 | 0.015 | 0.014 | 0.014 | 0.015 | 0.013 | 0.013 | 0.014 | 0.012 | 0.012 | 0.013 | 0.014 | 0.012 | 0.013 | 0.013 |
| Pb | 0.003 | 0.002 | 0.001 | 0.004 | 0.002 | 0.002 | 0.003 | 0.002 | 0.003 | 0.001 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.003 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.005 | 0.003 | 0.007 | 0.002 | 0.000 | 0.000 | 0.005 | 0.001 |
| Ca | 0.000 | 0.001 | 0.002 | 0.000 | 0.001 | 0.003 | 0.002 | 0.001 | 0.002 | 0.000 | 0.010 | 0.001 | 0.001 | 0.000 | 0.001 |
| Total | 2.985 | 2.987 | 2.996 | 2.986 | 2.986 | 2.990 | 2.986 | 2.989 | 2.990 | 2.985 | 2.983 | 2.985 | 2.983 | 2.992 | 2.987 |
| Mn/(Mn+Fe) | 0.843 | 0.841 | 0.841 | 0.842 | 0.843 | 0.850 | 0.842 | 0.840 | 0.840 | 0.842 | 0.836 | 0.795 | 0.808 | 0.791 | 0.812 |
| Ta/(Ta+Nb) | 0.535 | 0.533 | 0.533 | 0.534 | 0.532 | 0.534 | 0.532 | 0.531 | 0.535 | 0.532 | 0.532 | 0.533 | 0.531 | 0.535 | 0.533 |
| Comments: | grain 1<br>all unzoned | | | | | | | | | | | | | | |

**SW Beryl pegmatite**

96-86A

| | LA22 | LA23 | LA24 | LA25 | LA26 | LA27 | LA28 | LA29 | LA30 | LA31 | LA32 | LA33 | LA34 | LA35 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.79 | 2.66 | 2.62 | 2.66 | 2.54 | 2.62 | 2.65 | 2.63 | 2.64 | 2.71 | 2.49 | 2.52 | 2.63 | 2.83 |
| MnO | 13.36 | 13.49 | 13.54 | 13.50 | 13.37 | 13.63 | 13.55 | 13.48 | 13.53 | 13.25 | 12.68 | 13.60 | 13.48 | 13.58 |
| TiO2 | 0.27 | 0.22 | 0.21 | 0.22 | 0.23 | 0.24 | 0.21 | 0.26 | 0.27 | 0.29 | 0.27 | 0.30 | 0.31 | 0.19 |
| Nb2O5 | 28.41 | 28.39 | 29.48 | 29.02 | 27.59 | 29.12 | 28.82 | 28.62 | 28.22 | 28.26 | 27.20 | 28.53 | 29.07 | 32.15 |
| Ta2O5 | 54.36 | 54.15 | 54.03 | 54.25 | 53.34 | 54.07 | 54.15 | 54.16 | 54.12 | 54.26 | 55.18 | 53.82 | 54.05 | 51.59 |
| SnO2 | 0.21 | 0.19 | 0.17 | 0.18 | 0.18 | 0.17 | 0.14 | 0.20 | 0.21 | 0.20 | 0.17 | 0.09 | 0.08 | 0.03 |
| WO3 | 0.71 | 0.68 | 0.65 | 0.70 | 0.89 | 0.73 | 0.67 | 0.73 | 0.63 | 0.76 | 0.69 | 0.69 | 0.64 | 0.39 |
| PbO | 0.11 | 0.13 | 0.07 | 0.12 | 0.21 | 0.07 | 0.07 | 0.18 | 0.15 | 0.11 | 0.21 | 0.12 | 0.10 | 0.15 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.10 | 0.01 | 0.07 | 0.06 | 0.05 | 0.00 | 0.00 | 0.09 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| CaO | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.01 | 0.02 | 0.01 | 0.03 | 0.01 | 0.40 | 0.00 | 0.00 | 0.01 |
| Total | 100.24 | 100.03 | 100.79 | 100.74 | 98.43 | 100.72 | 100.27 | 100.27 | 99.89 | 99.87 | 99.33 | 99.68 | 100.36 | 100.92 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.167 | 0.159 | 0.155 | 0.158 | 0.155 | 0.156 | 0.158 | 0.157 | 0.158 | 0.163 | 0.151 | 0.151 | 0.157 | 0.165 |
| Mn | 0.809 | 0.819 | 0.812 | 0.812 | 0.826 | 0.819 | 0.819 | 0.816 | 0.822 | 0.806 | 0.780 | 0.827 | 0.813 | 0.803 |
| Ti | 0.015 | 0.012 | 0.011 | 0.012 | 0.012 | 0.013 | 0.011 | 0.014 | 0.015 | 0.015 | 0.015 | 0.016 | 0.016 | 0.010 |
| Nb | 0.919 | 0.920 | 0.944 | 0.932 | 0.910 | 0.934 | 0.930 | 0.925 | 0.915 | 0.918 | 0.892 | 0.926 | 0.936 | 1.015 |
| Ta | 1.057 | 1.055 | 1.041 | 1.048 | 1.059 | 1.043 | 1.051 | 1.053 | 1.056 | 1.060 | 1.089 | 1.051 | 1.047 | 0.979 |
| Sn | 0.006 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.006 | 0.006 | 0.006 | 0.005 | 0.003 | 0.002 | 0.001 |
| W | 0.013 | 0.013 | 0.012 | 0.013 | 0.017 | 0.013 | 0.012 | 0.014 | 0.012 | 0.014 | 0.013 | 0.013 | 0.012 | 0.007 |
| Pb | 0.002 | 0.003 | 0.001 | 0.002 | 0.004 | 0.001 | 0.001 | 0.004 | 0.003 | 0.002 | 0.004 | 0.002 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.006 | 0.000 | 0.004 | 0.004 | 0.003 | 0.000 | 0.000 | 0.006 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Ca | 0.002 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 | 0.031 | 0.000 | 0.000 | 0.001 |
| Total | 2.989 | 2.993 | 2.983 | 2.986 | 2.993 | 2.988 | 2.988 | 2.987 | 2.995 | 2.984 | 2.982 | 2.990 | 2.984 | 2.984 |
| | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.829 | 0.837 | 0.840 | 0.837 | 0.842 | 0.840 | 0.838 | 0.839 | 0.839 | 0.832 | 0.837 | 0.845 | 0.839 | 0.829 |
| Ta/(Ta+Nb) | 0.535 | 0.534 | 0.524 | 0.529 | 0.538 | 0.528 | 0.531 | 0.532 | 0.536 | 0.536 | 0.550 | 0.532 | 0.528 | 0.491 |

Comments:

grain 1

all unzoned

# Columbite-Tantalite Group

**SW Beryl pegmatite**

96-86A

| | LA36 | LA37 | LA38 | LA39 | LA40 | LA41 | LA42 | LA43 | LA44 | LA45 | LA46 | LA47 | LA48 | LA49 | LA50 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.84 | 2.81 | 2.85 | 2.85 | 2.92 | 2.85 | 3.14 | 3.38 | 3.43 | 3.43 | 3.45 | 2.94 | 3.06 | 3.19 | 3.32 |
| MnO | 13.63 | 13.73 | 13.60 | 13.45 | 13.09 | 13.11 | 13.99 | 13.89 | 13.80 | 13.89 | 13.83 | 13.02 | 13.58 | 13.00 | 12.73 |
| TiO2 | 0.23 | 0.23 | 0.29 | 0.29 | 0.33 | 0.29 | 0.28 | 0.28 | 0.27 | 0.26 | 0.29 | 0.33 | 0.33 | 0.34 | 0.29 |
| Nb2O5 | 31.69 | 33.52 | 31.88 | 30.56 | 28.77 | 28.35 | 39.68 | 40.29 | 42.07 | 41.04 | 41.54 | 27.04 | 35.27 | 29.26 | 27.45 |
| Ta2O5 | 51.60 | 50.48 | 50.10 | 52.10 | 54.41 | 54.22 | 42.77 | 40.57 | 40.12 | 41.42 | 40.48 | 56.65 | 47.72 | 54.08 | 56.11 |
| SnO2 | 0.08 | 0.02 | 0.03 | 0.06 | 0.07 | 0.06 | 0.06 | 0.02 | 0.06 | 0.04 | 0.04 | 0.07 | 0.07 | 0.07 | 0.13 |
| WO3 | 0.57 | 0.45 | 0.55 | 0.53 | 0.60 | 0.61 | 0.49 | 0.49 | 0.44 | 0.40 | 0.53 | 0.73 | 0.55 | 0.63 | 0.63 |
| PbO | 0.11 | 0.16 | 0.08 | 0.16 | 0.09 | 0.13 | 0.21 | 0.17 | 0.27 | 0.11 | 0.21 | 0.07 | 0.15 | 0.08 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | 0.00 | 0.04 |
| Sc2O3 | 0.00 | 0.01 | 0.00 | 0.01 | 0.06 | 0.09 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| CaO | 0.02 | 0.03 | 0.04 | 0.03 | 0.06 | 0.04 | 0.02 | 0.04 | 0.03 | 0.03 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 |
| Total | 100.76 | 101.45 | 99.43 | 100.06 | 100.39 | 99.79 | 100.63 | 99.13 | 100.57 | 100.62 | 100.41 | 100.88 | 100.76 | 100.71 | 100.76 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.166 | 0.162 | 0.168 | 0.169 | 0.174 | 0.171 | 0.176 | 0.191 | 0.190 | 0.191 | 0.192 | 0.176 | 0.176 | 0.189 | 0.199 |
| Mn | 0.808 | 0.802 | 0.813 | 0.807 | 0.790 | 0.797 | 0.796 | 0.796 | 0.776 | 0.785 | 0.780 | 0.790 | 0.790 | 0.781 | 0.772 |
| Ti | 0.012 | 0.012 | 0.016 | 0.016 | 0.017 | 0.016 | 0.014 | 0.014 | 0.013 | 0.013 | 0.014 | 0.018 | 0.017 | 0.018 | 0.016 |
| Nb | 1.003 | 1.045 | 1.018 | 0.978 | 0.927 | 0.920 | 1.205 | 1.233 | 1.263 | 1.237 | 1.251 | 0.876 | 1.095 | 0.938 | 0.889 |
| Ta | 0.982 | 0.947 | 0.962 | 1.003 | 1.054 | 1.059 | 0.781 | 0.747 | 0.724 | 0.751 | 0.734 | 1.104 | 0.891 | 1.043 | 1.093 |
| Sn | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.004 |
| W | 0.010 | 0.008 | 0.010 | 0.010 | 0.011 | 0.011 | 0.008 | 0.009 | 0.008 | 0.007 | 0.009 | 0.014 | 0.010 | 0.012 | 0.012 |
| Pb | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 | 0.004 | 0.003 | 0.005 | 0.002 | 0.004 | 0.001 | 0.003 | 0.002 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 |
| Sc | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.006 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ca | 0.002 | 0.002 | 0.003 | 0.002 | 0.005 | 0.003 | 0.001 | 0.003 | 0.002 | 0.002 | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 |
| Total | 2.988 | 2.983 | 2.993 | 2.990 | 2.985 | 2.988 | 2.988 | 2.997 | 2.987 | 2.990 | 2.989 | 2.982 | 2.983 | 2.986 | 2.985 |
| Mn/(Mn+Fe) | 0.829 | 0.832 | 0.828 | 0.827 | 0.820 | 0.823 | 0.819 | 0.806 | 0.803 | 0.804 | 0.803 | 0.818 | 0.818 | 0.805 | 0.795 |
| Ta/(Ta+Nb) | 0.495 | 0.475 | 0.486 | 0.506 | 0.532 | 0.535 | 0.393 | 0.377 | 0.365 | 0.378 | 0.370 | 0.558 | 0.449 | 0.527 | 0.551 |
| Comments: | grain 1<br>all unzoned | | | | grain 1<br>unzoned | | grain 1<br>patchy zonation | | | | | grain 1<br>unzoned | | | |

**SW Beryl pegmatite**

**96-86A**

| | LA51 | LA52 | LA53 | LA54 | LA55 | LA56 | LA57 | LA58 | LA59 | LA60 | LA61 | LA62 | LA63 | LA64 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 3.32 | 3.46 | 3.48 | 3.61 | 3.71 | 3.67 | 3.92 | 4.09 | 4.23 | 4.66 | 4.75 | 4.30 | 4.14 | 3.81 |
| MnO | 14.03 | 13.85 | 13.83 | 13.75 | 13.58 | 13.55 | 13.41 | 13.37 | 13.06 | 12.68 | 12.49 | 13.03 | 13.25 | 13.59 |
| TiO2 | 0.25 | 0.22 | 0.26 | 0.25 | 0.29 | 0.32 | 0.27 | 0.25 | 0.27 | 0.26 | 0.27 | 0.29 | 0.28 | 0.27 |
| Nb2O5 | 40.35 | 42.46 | 41.34 | 41.59 | 41.95 | 40.78 | 40.94 | 41.31 | 41.55 | 41.35 | 39.29 | 41.74 | 42.06 | 42.19 |
| Ta2O5 | 41.41 | 40.11 | 40.59 | 40.73 | 40.37 | 41.53 | 41.07 | 40.51 | 40.91 | 40.93 | 43.05 | 40.35 | 40.03 | 40.18 |
| SnO2 | 0.07 | 0.09 | 0.07 | 0.10 | 0.05 | 0.08 | 0.05 | 0.09 | 0.00 | 0.05 | 0.09 | 0.08 | 0.06 | 0.03 |
| WO3 | 0.45 | 0.48 | 0.42 | 0.53 | 0.45 | 0.54 | 0.39 | 0.56 | 0.44 | 0.43 | 0.45 | 0.41 | 0.45 | 0.38 |
| PbO | 0.11 | 0.14 | 0.17 | 0.17 | 0.17 | 0.18 | 0.19 | 0.20 | 0.19 | 0.14 | 0.18 | 0.14 | 0.20 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.00 | 0.04 | 0.01 | 0.05 | 0.00 | 0.00 | 0.02 | 0.04 | 0.00 | 0.00 | 0.04 | 0.09 | 0.06 |
| CaO | 0.04 | 0.03 | 0.03 | 0.02 | 0.04 | 0.02 | 0.03 | 0.03 | 0.01 | 0.03 | 0.03 | 0.05 | 0.02 | 0.03 |
| Total | 100.09 | 100.85 | 100.24 | 100.75 | 100.65 | 100.67 | 100.26 | 100.44 | 100.70 | 100.53 | 100.60 | 100.43 | 100.57 | 100.73 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.186 | 0.191 | 0.194 | 0.201 | 0.206 | 0.205 | 0.219 | 0.228 | 0.235 | 0.260 | 0.267 | 0.239 | 0.229 | 0.211 |
| Mn | 0.798 | 0.776 | 0.782 | 0.774 | 0.763 | 0.766 | 0.760 | 0.755 | 0.736 | 0.716 | 0.712 | 0.734 | 0.744 | 0.762 |
| Ti | 0.012 | 0.011 | 0.013 | 0.013 | 0.014 | 0.016 | 0.014 | 0.012 | 0.013 | 0.013 | 0.014 | 0.014 | 0.014 | 0.013 |
| Nb | 1.225 | 1.269 | 1.248 | 1.249 | 1.258 | 1.230 | 1.239 | 1.245 | 1.249 | 1.246 | 1.196 | 1.255 | 1.261 | 1.263 |
| Ta | 0.756 | 0.721 | 0.737 | 0.736 | 0.728 | 0.754 | 0.748 | 0.735 | 0.740 | 0.742 | 0.788 | 0.730 | 0.722 | 0.724 |
| Sn | 0.002 | 0.002 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.002 | 0.000 | 0.001 | 0.002 | 0.002 | 0.002 | 0.001 |
| W | 0.008 | 0.008 | 0.007 | 0.009 | 0.008 | 0.009 | 0.007 | 0.010 | 0.008 | 0.007 | 0.008 | 0.007 | 0.008 | 0.007 |
| Pb | 0.002 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 | 0.003 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.000 | 0.002 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.002 | 0.005 | 0.003 |
| Ca | 0.003 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.004 | 0.001 | 0.002 |
| Total | 2.996 | 2.984 | 2.992 | 2.989 | 2.987 | 2.987 | 2.992 | 2.995 | 2.987 | 2.989 | 2.992 | 2.990 | 2.991 | 2.990 |
| Mn/(Mn+Fe) | 0.811 | 0.802 | 0.801 | 0.794 | 0.788 | 0.789 | 0.776 | 0.768 | 0.758 | 0.734 | 0.727 | 0.754 | 0.764 | 0.783 |
| Ta/(Ta+Nb) | 0.382 | 0.362 | 0.371 | 0.371 | 0.367 | 0.380 | 0.376 | 0.371 | 0.372 | 0.373 | 0.397 | 0.368 | 0.364 | 0.364 |
| Comments: | grain 1<br>patchy zonation | | | | | | | | | grain 1<br>patchy zonation | | | | |

| | SW Beryl pegmatite | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-86A | | | | | | | | | | | | | | |
| | LA65 | LA66 | LA67 | LA68 | LA69 | LB | LC | LD | LE | LF | LG | LA | KA | KB | KC |
| FeO | 3.03 | 3.00 | 3.42 | 4.29 | 5.00 | 2.66 | 2.96 | 2.75 | 5.19 | 4.40 | 5.78 | 3.69 | 2.60 | 4.90 | 2.62 |
| MnO | 13.17 | 12.61 | 13.63 | 13.02 | 11.44 | 13.12 | 12.43 | 12.99 | 12.34 | 12.99 | 11.25 | 12.08 | 13.27 | 12.18 | 13.45 |
| TiO2 | 0.29 | 0.18 | 0.15 | 0.20 | 0.38 | 0.24 | 0.22 | 0.21 | 0.19 | 0.18 | 0.26 | 0.27 | 0.22 | 0.36 | 0.20 |
| Nb2O5 | 30.32 | 22.38 | 39.54 | 42.72 | 39.46 | 25.45 | 22.83 | 24.97 | 43.02 | 43.29 | 35.07 | 25.63 | 28.85 | 39.81 | 28.93 |
| Ta2O5 | 54.49 | 62.19 | 43.23 | 40.07 | 42.10 | 58.72 | 61.41 | 58.55 | 39.36 | 39.01 | 46.50 | 57.34 | 54.13 | 41.83 | 53.95 |
| SnO2 | 0.07 | 0.06 | 0.04 | 0.09 | 0.08 | 0.09 | 0.08 | 0.05 | 0.02 | 0.04 | 0.06 | 0.19 | 0.13 | 0.07 | 0.14 |
| WO3 | 0.47 | 0.46 | 0.34 | 0.41 | 0.51 | 0.53 | 0.51 | 0.51 | 0.39 | 0.36 | 0.53 | 0.68 | 0.76 | 0.55 | 0.70 |
| PbO | 0.16 | 0.09 | 0.18 | 0.18 | 0.10 | 0.08 | 0.12 | 0.07 | 0.19 | 0.21 | 0.15 | 0.07 | 0.18 | 0.22 | 0.18 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.05 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.04 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.00 | 0.01 | 0.01 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.06 | 0.00 | 0.02 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.25 | 0.05 | 0.00 | 0.00 | 0.16 | 0.00 | 0.12 | 0.00 | 0.00 | 0.09 | 0.04 | 0.00 | 0.13 | 0.00 | 0.00 |
| CaO | 0.06 | 0.03 | 0.04 | 0.01 | 0.11 | 0.02 | 0.05 | 0.01 | 0.05 | 0.04 | 0.04 | 0.02 | 0.01 | 0.01 | 0.00 |
| Total | 102.39 | 101.08 | 100.56 | 101.02 | 99.48 | 100.92 | 100.78 | 100.12 | 100.78 | 100.62 | 99.69 | 99.98 | 100.27 | 99.93 | 100.18 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.176 | 0.185 | 0.192 | 0.237 | 0.283 | 0.161 | 0.182 | 0.168 | 0.287 | 0.243 | 0.335 | 0.225 | 0.155 | 0.276 | 0.156 |
| Mn | 0.775 | 0.786 | 0.778 | 0.728 | 0.657 | 0.804 | 0.774 | 0.804 | 0.690 | 0.726 | 0.660 | 0.745 | 0.802 | 0.696 | 0.814 |
| Ti | 0.015 | 0.010 | 0.007 | 0.010 | 0.019 | 0.013 | 0.012 | 0.012 | 0.010 | 0.009 | 0.014 | 0.015 | 0.012 | 0.018 | 0.011 |
| Nb | 0.953 | 0.744 | 1.204 | 1.275 | 1.209 | 0.833 | 0.759 | 0.825 | 1.284 | 1.291 | 1.098 | 0.844 | 0.931 | 1.214 | 0.934 |
| Ta | 1.030 | 1.244 | 0.792 | 0.719 | 0.776 | 1.156 | 1.228 | 1.163 | 0.707 | 0.700 | 0.876 | 1.136 | 1.051 | 0.767 | 1.048 |
| Sn | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.005 | 0.004 | 0.002 | 0.004 |
| W | 0.008 | 0.009 | 0.006 | 0.007 | 0.009 | 0.010 | 0.010 | 0.010 | 0.007 | 0.006 | 0.009 | 0.013 | 0.014 | 0.010 | 0.013 |
| Pb | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.004 | 0.003 | 0.001 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.015 | 0.003 | 0.000 | 0.000 | 0.009 | 0.000 | 0.007 | 0.000 | 0.000 | 0.005 | 0.003 | 0.000 | 0.008 | 0.000 | 0.000 |
| Ca | 0.005 | 0.002 | 0.003 | 0.001 | 0.008 | 0.001 | 0.004 | 0.001 | 0.003 | 0.003 | 0.003 | 0.001 | 0.000 | 0.001 | 0.000 |
| Total | 2.983 | 2.987 | 2.986 | 2.982 | 2.977 | 2.982 | 2.982 | 2.985 | 2.991 | 2.988 | 3.003 | 2.985 | 2.980 | 2.988 | 2.985 |
| Mn/(Mn+Fe) | 0.815 | 0.810 | 0.802 | 0.755 | 0.699 | 0.833 | 0.810 | 0.827 | 0.707 | 0.749 | 0.663 | 0.768 | 0.838 | 0.716 | 0.839 |
| Ta/(Ta+Nb) | 0.519 | 0.626 | 0.397 | 0.361 | 0.391 | 0.581 | 0.618 | 0.585 | 0.355 | 0.352 | 0.444 | 0.574 | 0.530 | 0.387 | 0.529 |
| Comments: | grain 1<br>unzoned | | grain 1<br>patchy zonation | | | grain 1<br>unzoned | | | | | | | | | |

**SW Beryl pegmatite**

96-86A

| | KD | KE | KF | KG | KH | KI | KJ | KK | KL | KM | KN | KO | KP | KQ | KR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.57 | 5.22 | 4.05 | 4.63 | 3.72 | 2.63 | 5.01 | 5.14 | 4.37 | 4.18 | 3.77 | 3.96 | 2.76 | 5.51 | 5.81 |
| MnO | 13.33 | 11.74 | 13.28 | 12.19 | 13.28 | 13.32 | 11.99 | 12.08 | 11.90 | 12.17 | 11.71 | 11.88 | 12.54 | 11.49 | 10.66 |
| TiO2 | 0.25 | 0.56 | 0.28 | 0.36 | 0.20 | 0.22 | 0.31 | 0.30 | 0.29 | 0.28 | 0.18 | 0.37 | 0.27 | 0.47 | 0.43 |
| Nb2O5 | 28.99 | 40.01 | 43.82 | 39.64 | 41.32 | 29.15 | 39.56 | 41.05 | 30.98 | 31.62 | 21.55 | 29.49 | 20.67 | 40.43 | 33.28 |
| Ta2O5 | 53.66 | 40.81 | 36.50 | 41.37 | 39.91 | 53.49 | 41.56 | 39.77 | 51.19 | 51.43 | 62.05 | 52.23 | 62.88 | 40.85 | 48.90 |
| SnO2 | 0.17 | 0.15 | 0.05 | 0.07 | 0.04 | 0.17 | 0.04 | 0.03 | 0.04 | 0.04 | 0.09 | 0.09 | 0.10 | 0.07 | 0.15 |
| WO3 | 0.75 | 0.68 | 0.65 | 0.61 | 0.40 | 0.76 | 0.50 | 0.44 | 0.47 | 0.50 | 0.43 | 0.73 | 0.34 | 0.53 | 0.54 |
| PbO | 0.17 | 0.23 | 0.22 | 0.15 | 0.16 | 0.07 | 0.13 | 0.20 | 0.18 | 0.18 | 0.10 | 0.21 | 0.15 | 0.09 | 0.06 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.01 | 0.00 | 0.00 | 0.05 | 0.02 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.04 | 0.04 | 0.04 | 0.00 | 0.00 | 0.09 | 0.00 | 0.05 | 0.03 | 0.09 | 0.00 | 0.05 | 0.10 | 0.00 | 0.05 |
| CaO | 0.01 | 0.02 | 0.02 | 0.05 | 0.04 | 0.00 | 0.04 | 0.03 | 0.01 | 0.02 | 0.02 | 0.09 | 0.02 | 0.03 | 0.02 |
| Total | 99.96 | 99.46 | 98.90 | 99.09 | 99.08 | 99.92 | 99.13 | 99.08 | 99.47 | 100.51 | 99.91 | 99.09 | 99.80 | 99.47 | 99.89 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.154 | 0.295 | 0.226 | 0.263 | 0.210 | 0.157 | 0.285 | 0.290 | 0.260 | 0.245 | 0.236 | 0.238 | 0.173 | 0.311 | 0.339 |
| Mn | 0.807 | 0.671 | 0.749 | 0.701 | 0.759 | 0.806 | 0.690 | 0.690 | 0.716 | 0.723 | 0.741 | 0.722 | 0.797 | 0.656 | 0.629 |
| Ti | 0.013 | 0.029 | 0.014 | 0.018 | 0.010 | 0.012 | 0.016 | 0.015 | 0.015 | 0.015 | 0.010 | 0.020 | 0.015 | 0.024 | 0.022 |
| Nb | 0.937 | 1.221 | 1.320 | 1.218 | 1.260 | 0.941 | 1.216 | 1.252 | 0.995 | 1.003 | 0.728 | 0.956 | 0.701 | 1.232 | 1.049 |
| Ta | 1.044 | 0.749 | 0.661 | 0.764 | 0.732 | 1.039 | 0.768 | 0.730 | 0.989 | 0.981 | 1.260 | 1.019 | 1.283 | 0.749 | 0.927 |
| Sn | 0.005 | 0.004 | 0.001 | 0.002 | 0.001 | 0.005 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.003 | 0.002 | 0.004 |
| W | 0.014 | 0.012 | 0.011 | 0.011 | 0.007 | 0.014 | 0.009 | 0.008 | 0.009 | 0.009 | 0.008 | 0.014 | 0.007 | 0.009 | 0.010 |
| Pb | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.001 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.004 | 0.003 | 0.002 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.003 | 0.002 | 0.002 | 0.000 | 0.000 | 0.006 | 0.000 | 0.003 | 0.002 | 0.006 | 0.000 | 0.003 | 0.006 | 0.000 | 0.003 |
| Ca | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.000 | 0.003 | 0.002 | 0.001 | 0.001 | 0.001 | 0.007 | 0.001 | 0.002 | 0.002 |
| Total | 2.981 | 2.988 | 2.990 | 2.985 | 2.986 | 2.982 | 2.990 | 2.994 | 2.990 | 2.988 | 2.989 | 2.985 | 2.989 | 2.985 | 2.987 |
| Mn/(Mn+Fe) | 0.840 | 0.695 | 0.769 | 0.727 | 0.784 | 0.837 | 0.708 | 0.704 | 0.734 | 0.747 | 0.759 | 0.752 | 0.821 | 0.679 | 0.650 |
| Ta/(Ta+Nb) | 0.527 | 0.380 | 0.334 | 0.386 | 0.368 | 0.525 | 0.387 | 0.368 | 0.498 | 0.495 | 0.634 | 0.516 | 0.647 | 0.378 | 0.469 |
| Comments: | | | | | | | | grain 1<br>unzoned | | | | | | | |

# Columbite-Tantalite Group

| | SW Beryl pegmatite<br>96-86A | | | | | | | | SW Beryl pegmatite<br>96-86B | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | KS | KT | KU | KV | KW | KX | KY | KZ | JC | JD | JF | JG | JH | JI |
| FeO | 4.54 | 4.57 | 5.38 | 5.69 | 4.41 | 3.36 | 4.76 | 2.63 | 11.68 | 12.04 | 11.40 | 13.27 | 14.03 | 10.04 |
| MnO | 11.45 | 11.68 | 11.86 | 11.02 | 12.64 | 13.25 | 12.07 | 14.28 | 8.99 | 8.47 | 9.22 | 7.37 | 6.28 | 10.28 |
| TiO2 | 0.39 | 0.30 | 0.28 | 0.38 | 0.35 | 0.16 | 0.22 | 0.20 | 0.53 | 0.45 | 0.45 | 0.64 | 0.63 | 0.42 |
| Nb2O5 | 27.39 | 30.43 | 39.25 | 35.29 | 40.12 | 36.04 | 36.51 | 37.02 | 64.83 | 64.37 | 65.36 | 64.91 | 63.81 | 63.05 |
| Ta2O5 | 55.09 | 52.32 | 41.73 | 46.03 | 41.65 | 45.22 | 45.30 | 44.45 | 12.68 | 13.05 | 12.29 | 11.87 | 13.76 | 15.01 |
| SnO2 | 0.05 | 0.13 | 0.05 | 0.08 | 0.02 | 0.09 | 0.07 | 0.13 | 0.23 | 0.19 | 0.06 | 0.00 | 0.26 | 0.00 |
| WO3 | 0.42 | 0.53 | 0.47 | 0.49 | 0.46 | 0.75 | 0.72 | 0.80 | 0.24 | 0.41 | 0.37 | 0.30 | 0.35 | 0.08 |
| PbO | 0.06 | 0.11 | 0.21 | 0.16 | 0.15 | 0.13 | 0.13 | 0.17 | 0.49 | 0.24 | 0.37 | 0.37 | 0.48 | 0.58 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.39 | 0.42 | 0.00 | 0.27 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.15 | 0.00 | 0.10 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.34 | 0.00 | 0.22 | 0.00 | 0.00 |
| Sc2O3 | 0.10 | 0.02 | 0.01 | 0.07 | 0.01 | 0.00 | 0.00 | 0.00 | 0.68 | 0.00 | 0.00 | 0.31 | 0.00 | 0.00 |
| CaO | 0.01 | 0.02 | 0.03 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | | | | | | |
| Total | 99.49 | 100.12 | 99.27 | 99.21 | 99.80 | 99.03 | 99.77 | 99.68 | 100.47 | 100.11 | 99.93 | 99.36 | 99.88 | 99.47 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.274 | 0.270 | 0.306 | 0.331 | 0.248 | 0.195 | 0.274 | 0.151 | 0.577 | 0.601 | 0.567 | 0.662 | 0.703 | 0.507 |
| Mn | 0.701 | 0.700 | 0.684 | 0.648 | 0.721 | 0.779 | 0.703 | 0.830 | 0.450 | 0.429 | 0.465 | 0.372 | 0.319 | 0.526 |
| Ti | 0.021 | 0.016 | 0.014 | 0.020 | 0.018 | 0.008 | 0.011 | 0.010 | 0.024 | 0.020 | 0.020 | 0.029 | 0.028 | 0.019 |
| Nb | 0.895 | 0.974 | 1.207 | 1.108 | 1.223 | 1.131 | 1.135 | 1.148 | 1.732 | 1.738 | 1.758 | 1.750 | 1.727 | 1.720 |
| Ta | 1.083 | 1.008 | 0.772 | 0.869 | 0.763 | 0.853 | 0.847 | 0.829 | 0.204 | 0.212 | 0.199 | 0.193 | 0.224 | 0.246 |
| Sn | 0.001 | 0.004 | 0.001 | 0.002 | 0.001 | 0.003 | 0.002 | 0.004 | 0.006 | 0.005 | 0.001 | 0.000 | 0.006 | 0.000 |
| W | 0.008 | 0.010 | 0.008 | 0.009 | 0.008 | 0.014 | 0.013 | 0.014 | 0.004 | 0.006 | 0.006 | 0.005 | 0.005 | 0.001 |
| Pb | 0.001 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.008 | 0.004 | 0.006 | 0.006 | 0.008 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.006 | 0.000 | 0.004 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.004 | 0.000 | 0.002 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.003 | 0.000 | 0.000 |
| Sc | 0.006 | 0.001 | 0.000 | 0.004 | 0.001 | 0.000 | 0.000 | 0.000 | 0.035 | 0.000 | 0.000 | 0.016 | 0.000 | 0.000 |
| Ca | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | | | | | | |
| Total | 2.992 | 2.987 | 2.999 | 2.993 | 2.986 | 2.986 | 2.987 | 2.991 | 3.041 | 3.028 | 3.027 | 3.037 | 3.024 | 3.029 |
| Mn/(Mn+Fe) | 0.719 | 0.721 | 0.691 | 0.662 | 0.744 | 0.800 | 0.720 | 0.846 | 0.438 | 0.416 | 0.450 | 0.360 | 0.312 | 0.509 |
| Ta/(Ta+Nb) | 0.547 | 0.508 | 0.390 | 0.440 | 0.384 | 0.430 | 0.427 | 0.419 | 0.105 | 0.109 | 0.102 | 0.099 | 0.115 | 0.125 |
| Comments: | | | | grain 1<br>unzoned | | | | | | | | | | |

| | **SW Beryl pegmatite** | | | | **Marko's pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-86B | | | | 96-AT1 | | | | | | |
| | MA1 | MA2 | MA3 | MA4 | SG | SM | TA | TB | TC | TR26 | TR27 |
| FeO | 9.48 | 9.56 | 9.48 | 9.45 | 7.86 | 11.01 | 10.90 | 9.58 | 7.86 | 9.33 | 11.01 |
| MnO | 10.02 | 10.04 | 10.04 | 9.70 | 10.20 | 6.56 | 5.83 | 9.01 | 10.20 | 8.95 | 7.03 |
| TiO2 | 0.54 | 0.58 | 0.59 | 0.50 | 1.02 | 0.55 | 0.69 | 0.66 | 1.02 | 0.79 | 0.87 |
| Nb2O5 | 62.74 | 62.25 | 61.57 | 58.67 | 50.12 | 44.92 | 43.35 | 53.79 | 50.12 | 55.11 | 53.22 |
| Ta2O5 | 15.88 | 16.02 | 16.18 | 19.84 | 29.26 | 35.58 | 36.20 | 25.39 | 29.26 | 25.13 | 26.90 |
| SnO2 | 0.11 | 0.11 | 0.14 | 0.10 | 0.18 | 0.08 | 0.13 | 0.06 | 0.18 | 0.10 | 0.11 |
| WO3 | 0.65 | 0.67 | 0.78 | 0.66 | 0.72 | 0.69 | 0.66 | 0.72 | 0.72 | 0.86 | 0.72 |
| PbO | 0.28 | 0.30 | 0.30 | 0.23 | 0.21 | 0.16 | 0.17 | 0.32 | 0.28 | 0.27 | 0.28 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.23 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.11 | 0.00 | 0.00 | 0.00 | 0.16 | 0.01 | 0.04 | 0.11 | 0.23 | 0.07 | 0.22 |
| CaO | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 |
| Total | 99.80 | 99.54 | 99.08 | 99.14 | 99.74 | 99.55 | 98.21 | 99.64 | 99.89 | 100.61 | 100.37 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.477 | 0.483 | 0.482 | 0.487 | 0.418 | 0.605 | 0.611 | 0.503 | 0.418 | 0.483 | 0.576 |
| Mn | 0.510 | 0.514 | 0.517 | 0.506 | 0.550 | 0.366 | 0.331 | 0.479 | 0.549 | 0.470 | 0.372 |
| Ti | 0.025 | 0.026 | 0.027 | 0.023 | 0.049 | 0.027 | 0.035 | 0.031 | 0.049 | 0.037 | 0.041 |
| Nb | 1.706 | 1.700 | 1.692 | 1.635 | 1.442 | 1.335 | 1.313 | 1.527 | 1.440 | 1.543 | 1.504 |
| Ta | 0.260 | 0.263 | 0.268 | 0.333 | 0.506 | 0.636 | 0.659 | 0.433 | 0.506 | 0.423 | 0.457 |
| Sn | 0.003 | 0.003 | 0.003 | 0.003 | 0.005 | 0.002 | 0.004 | 0.002 | 0.005 | 0.002 | 0.003 |
| W | 0.010 | 0.010 | 0.012 | 0.010 | 0.012 | 0.012 | 0.011 | 0.012 | 0.012 | 0.014 | 0.012 |
| Pb | 0.004 | 0.005 | 0.005 | 0.004 | 0.004 | 0.003 | 0.003 | 0.005 | 0.005 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.000 | 0.000 | 0.000 | 0.009 | 0.001 | 0.002 | 0.006 | 0.013 | 0.004 | 0.012 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 |
| Total | 3.001 | 3.005 | 3.006 | 3.002 | 2.996 | 2.989 | 2.975 | 3.000 | 2.998 | 2.982 | 2.984 |
| Mn/(Mn+Fe) | 0.517 | 0.515 | 0.517 | 0.510 | 0.568 | 0.377 | 0.352 | 0.488 | 0.568 | 0.493 | 0.393 |
| Ta/(Ta+Nb) | 0.132 | 0.134 | 0.137 | 0.169 | 0.260 | 0.323 | 0.334 | 0.221 | 0.260 | 0.215 | 0.233 |
| Comments: | | | | | early columbite?<br>mainly replaced<br>by microlite | | core zone<br>light BSE | | rim | | |

| | **Marko's peg.** | | **Marko's peg.** | | **Marko's pegmatite** | | | | | **Marko's pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT1 | | 96-AT5 | | 96-AT6 | | | | | 96-AT7 | | | | | |
| | TR29 | TR47 | BF | BI | CA | CB | CF | CG | CH | DA | DB | DD | DI | DJ | DK |
| FeO | 9.08 | 7.34 | 2.39 | 2.35 | 8.22 | 9.94 | 7.98 | 9.35 | 8.37 | 11.08 | 10.97 | 11.31 | 10.47 | 8.71 | 10.98 |
| MnO | 9.12 | 10.86 | 12.81 | 12.57 | 9.85 | 8.32 | 10.08 | 8.86 | 9.94 | 7.54 | 7.39 | 7.06 | 7.97 | 8.10 | 7.28 |
| TiO2 | 0.61 | 1.15 | 1.77 | 1.83 | 2.33 | 1.92 | 2.90 | 2.16 | 1.97 | 1.98 | 1.99 | 1.84 | 1.90 | 3.00 | 1.95 |
| Nb2O5 | 51.43 | 52.96 | 24.02 | 24.38 | 53.38 | 56.56 | 52.39 | 55.11 | 56.49 | 59.74 | 59.59 | 58.93 | 60.80 | 51.76 | 60.83 |
| Ta2O5 | 28.68 | 27.18 | 58.28 | 57.28 | 22.92 | 20.43 | 23.24 | 21.91 | 19.99 | 17.33 | 17.77 | 18.37 | 16.79 | 24.05 | 16.82 |
| SnO2 | 0.11 | 0.36 | 0.58 | 0.58 | 0.36 | 0.27 | 0.43 | 0.30 | 0.31 | 0.20 | 0.08 | 0.14 | 0.14 | 0.77 | 0.10 |
| WO3 | 0.74 | 0.65 | 0.60 | 0.66 | 1.12 | 1.07 | 1.21 | 1.16 | 1.14 | 0.90 | 1.02 | 1.05 | 1.06 | 1.03 | 1.09 |
| PbO | 0.26 | 0.28 | 0.19 | 0.08 | 0.32 | 0.25 | 0.42 | 0.25 | 0.33 | 0.28 | 0.26 | 0.29 | 0.30 | 0.40 | 0.33 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.06 | 0.14 | 0.00 | 0.00 | 0.40 | 0.34 | 0.25 | 0.22 | 0.30 | 0.41 | 0.38 | 0.36 | 0.39 | 0.75 | 0.37 |
| CaO | 0.02 | 0.03 | 0.03 | 0.05 | 0.01 | 0.03 | 0.07 | 0.03 | 0.18 | 0.06 | 0.08 | 0.07 | 0.08 | 0.38 | 0.08 |
| Total | 100.08 | 100.92 | 100.68 | 99.79 | 98.90 | 99.12 | 99.14 | 99.34 | 99.02 | 99.52 | 99.52 | 99.41 | 99.89 | 99.07 | 99.83 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.481 | 0.382 | 0.144 | 0.142 | 0.428 | 0.511 | 0.415 | 0.482 | 0.430 | 0.559 | 0.554 | 0.574 | 0.525 | 0.453 | 0.551 |
| Mn | 0.489 | 0.572 | 0.782 | 0.770 | 0.519 | 0.433 | 0.531 | 0.463 | 0.517 | 0.385 | 0.378 | 0.363 | 0.405 | 0.427 | 0.370 |
| Ti | 0.029 | 0.054 | 0.096 | 0.100 | 0.109 | 0.089 | 0.136 | 0.100 | 0.091 | 0.090 | 0.090 | 0.084 | 0.086 | 0.140 | 0.088 |
| Nb | 1.473 | 1.489 | 0.782 | 0.798 | 1.502 | 1.571 | 1.473 | 1.537 | 1.570 | 1.629 | 1.627 | 1.617 | 1.647 | 1.455 | 1.649 |
| Ta | 0.494 | 0.460 | 1.142 | 1.127 | 0.388 | 0.341 | 0.393 | 0.367 | 0.334 | 0.284 | 0.292 | 0.303 | 0.274 | 0.407 | 0.274 |
| Sn | 0.003 | 0.009 | 0.017 | 0.017 | 0.009 | 0.007 | 0.011 | 0.007 | 0.008 | 0.005 | 0.002 | 0.003 | 0.003 | 0.019 | 0.002 |
| W | 0.012 | 0.010 | 0.011 | 0.012 | 0.018 | 0.017 | 0.020 | 0.019 | 0.018 | 0.014 | 0.016 | 0.017 | 0.016 | 0.017 | 0.017 |
| Pb | 0.004 | 0.005 | 0.004 | 0.002 | 0.005 | 0.004 | 0.007 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.007 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.003 | 0.007 | 0.000 | 0.000 | 0.022 | 0.018 | 0.014 | 0.012 | 0.016 | 0.021 | 0.020 | 0.019 | 0.020 | 0.041 | 0.019 |
| Ca | 0.001 | 0.002 | 0.002 | 0.004 | 0.001 | 0.002 | 0.004 | 0.002 | 0.012 | 0.004 | 0.005 | 0.004 | 0.005 | 0.025 | 0.005 |
| Total | 2.991 | 2.990 | 2.979 | 2.972 | 3.000 | 2.993 | 3.006 | 2.993 | 3.002 | 2.996 | 2.988 | 2.990 | 2.986 | 2.992 | 2.981 |
| Mn/(Mn+Fe) | 0.504 | 0.600 | 0.844 | 0.844 | 0.548 | 0.459 | 0.561 | 0.490 | 0.546 | 0.408 | 0.406 | 0.387 | 0.435 | 0.485 | 0.402 |
| Ta/(Ta+Nb) | 0.251 | 0.236 | 0.593 | 0.586 | 0.205 | 0.178 | 0.211 | 0.193 | 0.175 | 0.149 | 0.152 | 0.158 | 0.142 | 0.218 | 0.143 |
| Comments: | Sb betafite/<br>Sb microlite<br>traverse | | BF & BI<br>same grain<br>incl. in cass. | | CA - CH same grain<br>contains microlite inclusions<br>patchy zonation - replacement texture | | | | | DA - DK same grain<br>contains microlite inclusions<br>patchy zonation - replacement texture | | | | | |

**Marko's pegmatite**

96-AT8

| | EA | EB | EC | ED | EF | EG | EH | EK | EL | EM | EN | EO | EP | EQ | ES |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 2.93 | 3.12 | 3.10 | 3.17 | 2.73 | 2.63 | 2.79 | 2.74 | 2.86 | 2.74 | 2.56 | 2.60 | 2.42 | 2.83 | 2.81 |
| MnO | 14.11 | 14.04 | 13.85 | 13.67 | 13.35 | 13.03 | 13.32 | 13.45 | 12.43 | 12.82 | 12.73 | 12.87 | 12.62 | 12.67 | 12.52 |
| $TiO_2$ | 1.86 | 2.05 | 1.98 | 2.49 | 0.83 | 1.00 | 0.94 | 1.47 | 3.09 | 1.37 | 0.63 | 0.75 | 0.66 | 2.37 | 2.59 |
| $Nb_2O_5$ | 42.87 | 41.39 | 42.10 | 41.21 | 29.14 | 24.24 | 30.55 | 30.47 | 28.63 | 23.34 | 20.26 | 21.60 | 19.75 | 28.31 | 26.24 |
| $Ta_2O_5$ | 36.17 | 36.50 | 35.91 | 36.16 | 52.73 | 58.15 | 50.47 | 50.05 | 48.94 | 58.78 | 62.24 | 61.26 | 62.57 | 50.32 | 51.81 |
| $SnO_2$ | 0.48 | 0.49 | 0.71 | 0.58 | 0.40 | 0.50 | 0.00 | 0.29 | 1.17 | 0.43 | 0.50 | 0.24 | 0.37 | 0.67 | 0.36 |
| $WO_3$ | 1.07 | 0.77 | 0.53 | 1.18 | 0.82 | 0.70 | 0.56 | 0.66 | 0.59 | 0.41 | 0.58 | 0.73 | 0.49 | 0.86 | 1.28 |
| PbO | 0.59 | 0.53 | 0.00 | 0.46 | 0.00 | 0.29 | 0.26 | 0.00 | 0.57 | 0.00 | 0.19 | 0.00 | 0.68 | 0.25 | 0.36 |
| $ThO_2$ | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $UO_2$ | 0.00 | 0.00 | 0.07 | 0.00 | 0.06 | 0.29 | 0.42 | 0.00 | 0.53 | 0.00 | 0.00 | 0.00 | 0.63 | 0.12 | 0.00 |
| $Sb_2O_3$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Bi_2O_3$ | 0.05 | 0.00 | 0.00 | 0.03 | 0.09 | 0.00 | 0.00 | 0.15 | 0.19 | 0.03 | 0.14 | 0.00 | 0.00 | 0.00 | 0.02 |
| $Sc_2O_3$ | 0.00 | 0.55 | 0.67 | 0.00 | 0.00 | 0.23 | 1.10 | 0.09 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.43 | 1.01 |
| CaO | | | | | | | | | | | | | | | |
| Total | 100.11 | 99.43 | 98.92 | 98.98 | 100.16 | 101.05 | 100.52 | 99.36 | 98.99 | 99.91 | 100.23 | 100.04 | 100.19 | 98.83 | 99.01 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.160 | 0.172 | 0.170 | 0.175 | 0.162 | 0.159 | 0.163 | 0.161 | 0.169 | 0.167 | 0.159 | 0.161 | 0.153 | 0.167 | 0.167 |
| Mn | 0.783 | 0.784 | 0.772 | 0.766 | 0.802 | 0.797 | 0.787 | 0.801 | 0.743 | 0.792 | 0.803 | 0.807 | 0.805 | 0.760 | 0.753 |
| Ti | 0.092 | 0.102 | 0.098 | 0.124 | 0.044 | 0.054 | 0.049 | 0.078 | 0.164 | 0.075 | 0.035 | 0.042 | 0.037 | 0.126 | 0.139 |
| Nb | 1.269 | 1.234 | 1.253 | 1.233 | 0.934 | 0.791 | 0.963 | 0.969 | 0.913 | 0.770 | 0.682 | 0.723 | 0.672 | 0.906 | 0.843 |
| Ta | 0.644 | 0.654 | 0.643 | 0.651 | 1.016 | 1.141 | 0.957 | 0.958 | 0.939 | 1.166 | 1.261 | 1.234 | 1.281 | 0.969 | 1.001 |
| Sn | 0.012 | 0.013 | 0.019 | 0.015 | 0.011 | 0.014 | 0.000 | 0.008 | 0.033 | 0.012 | 0.015 | 0.007 | 0.011 | 0.019 | 0.010 |
| W | 0.018 | 0.013 | 0.009 | 0.020 | 0.015 | 0.013 | 0.010 | 0.012 | 0.011 | 0.008 | 0.011 | 0.014 | 0.010 | 0.016 | 0.024 |
| Pb | 0.010 | 0.009 | 0.000 | 0.008 | 0.000 | 0.006 | 0.005 | 0.000 | 0.011 | 0.000 | 0.004 | 0.000 | 0.014 | 0.005 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.005 | 0.006 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.011 | 0.002 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.003 | 0.003 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.031 | 0.038 | 0.000 | 0.000 | 0.015 | 0.067 | 0.005 | 0.000 | 0.000 | 0.025 | 0.000 | 0.000 | 0.026 | 0.063 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.989 | 3.012 | 3.002 | 2.994 | 2.987 | 2.994 | 3.010 | 2.996 | 2.994 | 2.992 | 2.999 | 2.988 | 2.992 | 2.996 | 3.007 |
| Mn/(Mn+Fe) | 0.830 | 0.820 | 0.819 | 0.814 | 0.832 | 0.834 | 0.829 | 0.832 | 0.815 | 0.826 | 0.835 | 0.834 | 0.841 | 0.819 | 0.818 |
| Ta/(Ta+Nb) | 0.337 | 0.347 | 0.339 | 0.345 | 0.521 | 0.591 | 0.498 | 0.497 | 0.507 | 0.602 | 0.649 | 0.630 | 0.656 | 0.517 | 0.543 |
| Comments: | EA & EB<br>same grain | | | | | EF - EH<br>same grain | | EK & EL<br>same grain | | | EM - EP<br>same grain | | | | |

| | Marko's pegmatite | | | | | | | Marko's pegmatite | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT9 | | | | | | | 96-AT10 | | | | | | | |
| | MA | MB | MD | ME | MF | MG | MH | TA | TB | TC | TE | TG | TH | TJ | TK |
| FeO | 11.44 | 12.93 | 10.75 | 11.72 | 10.27 | 11.03 | 10.71 | 4.66 | 4.70 | 5.07 | 4.70 | 3.64 | 3.82 | 4.63 | 4.68 |
| MnO | 6.78 | 6.13 | 7.42 | 6.18 | 7.43 | 7.75 | 7.46 | 13.05 | 13.09 | 12.88 | 13.04 | 14.40 | 13.97 | 13.32 | 12.97 |
| TiO2 | 2.76 | 0.80 | 2.79 | 3.52 | 3.17 | 1.09 | 2.58 | 1.87 | 1.82 | 1.94 | 1.57 | 1.43 | 1.64 | 1.78 | 2.03 |
| Nb2O5 | 56.23 | 56.12 | 56.37 | 53.00 | 56.64 | 55.45 | 57.13 | 51.34 | 52.88 | 51.59 | 51.97 | 53.43 | 52.64 | 52.31 | 52.67 |
| Ta2O5 | 20.24 | 22.61 | 19.83 | 22.11 | 20.08 | 22.95 | 19.54 | 26.14 | 25.54 | 25.05 | 25.94 | 24.39 | 25.99 | 25.22 | 25.00 |
| SnO2 | 0.27 | 0.04 | 0.26 | 0.42 | 0.31 | 0.13 | 0.40 | 0.38 | 0.41 | 0.45 | 0.24 | 0.30 | 0.43 | 0.43 | 0.43 |
| WO3 | 0.86 | 0.68 | 0.82 | 0.94 | 0.88 | 0.96 | 0.87 | 1.11 | 1.05 | 1.09 | 1.18 | 1.10 | 1.11 | 1.10 | 1.11 |
| PbO | 0.43 | 0.28 | 0.34 | 0.34 | 0.36 | 0.27 | 0.29 | 0.30 | 0.28 | 0.28 | 0.23 | 0.29 | 0.27 | 0.30 | 0.25 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.18 | 0.22 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.31 | 0.17 | 0.47 | 0.35 | 0.47 | 0.35 | 0.57 | 0.15 | 0.30 | 0.27 | 0.15 | 0.19 | 0.17 | 0.13 | 0.21 |
| CaO | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.02 | 0.02 | 0.04 | 0.15 | 0.05 | 0.02 | 0.03 | 0.04 | 0.04 |
| Total | 99.31 | 99.75 | 99.03 | 98.77 | 99.85 | 99.98 | 99.57 | 99.05 | 100.12 | 98.76 | 99.06 | 99.20 | 100.11 | 99.25 | 99.46 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.585 | 0.670 | 0.549 | 0.606 | 0.520 | 0.570 | 0.544 | 0.246 | 0.244 | 0.267 | 0.248 | 0.191 | 0.199 | 0.243 | 0.244 |
| Mn | 0.351 | 0.321 | 0.384 | 0.324 | 0.381 | 0.406 | 0.384 | 0.698 | 0.689 | 0.688 | 0.697 | 0.764 | 0.738 | 0.708 | 0.686 |
| Ti | 0.127 | 0.037 | 0.128 | 0.164 | 0.144 | 0.051 | 0.118 | 0.089 | 0.085 | 0.092 | 0.074 | 0.068 | 0.077 | 0.084 | 0.095 |
| Nb | 1.554 | 1.572 | 1.557 | 1.483 | 1.551 | 1.549 | 1.568 | 1.465 | 1.486 | 1.470 | 1.482 | 1.513 | 1.484 | 1.485 | 1.487 |
| Ta | 0.336 | 0.381 | 0.329 | 0.372 | 0.331 | 0.386 | 0.323 | 0.449 | 0.432 | 0.429 | 0.445 | 0.415 | 0.441 | 0.431 | 0.424 |
| Sn | 0.006 | 0.001 | 0.006 | 0.010 | 0.008 | 0.003 | 0.010 | 0.010 | 0.010 | 0.011 | 0.006 | 0.007 | 0.011 | 0.011 | 0.011 |
| W | 0.014 | 0.011 | 0.013 | 0.015 | 0.014 | 0.015 | 0.014 | 0.018 | 0.017 | 0.018 | 0.019 | 0.018 | 0.018 | 0.018 | 0.018 |
| Pb | 0.007 | 0.005 | 0.006 | 0.006 | 0.006 | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.002 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.016 | 0.009 | 0.025 | 0.019 | 0.025 | 0.019 | 0.030 | 0.008 | 0.016 | 0.015 | 0.008 | 0.010 | 0.009 | 0.007 | 0.011 |
| Ca | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.003 | 0.010 | 0.003 | 0.001 | 0.002 | 0.003 | 0.003 |
| Total | 2.996 | 3.007 | 2.997 | 3.002 | 2.983 | 3.003 | 2.995 | 2.990 | 2.986 | 3.005 | 2.987 | 2.992 | 2.984 | 2.994 | 2.985 |
| Mn/(Mn+Fe) | 0.375 | 0.324 | 0.412 | 0.348 | 0.423 | 0.416 | 0.414 | 0.739 | 0.738 | 0.720 | 0.738 | 0.800 | 0.787 | 0.745 | 0.737 |
| Ta/(Ta+Nb) | 0.178 | 0.195 | 0.175 | 0.201 | 0.176 | 0.199 | 0.171 | 0.234 | 0.225 | 0.226 | 0.231 | 0.215 | 0.229 | 0.225 | 0.222 |
| Comments: | | MA - ME | | | | MF - MH same grain | | TA & TB | | | | | | TJ & TK | |
| | | same grain | | | unzoned | mottled | complex | same grain | | | | | | same grain | |
| | unzoned | | unzoned | mottled | rim | | core | | | | | | | | |

| | **Marko's peg.** | | | | **Marko's peg.** | | **School of Fish pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT16 | | | | 96-AT19B | | 97-1 | | | | | | |
| | PA | PB | PC | PD | DS | DZ | CC | CD | QD | QH | QE | QF | QG |
| FeO | 7.84 | 7.56 | 6.36 | 7.92 | 4.27 | 5.35 | 8.60 | 9.00 | 7.05 | 7.11 | 8.21 | 8.51 | 7.02 |
| MnO | 10.11 | 10.67 | 11.67 | 10.36 | 11.02 | 10.27 | 7.17 | 6.80 | 10.67 | 10.43 | 8.19 | 8.20 | 9.57 |
| TiO2 | 1.96 | 1.68 | 2.29 | 1.63 | 0.96 | 1.29 | 0.70 | 0.64 | 0.50 | 0.53 | 1.09 | 1.15 | 0.69 |
| Nb2O5 | 51.87 | 53.50 | 51.84 | 54.84 | 21.38 | 23.78 | 26.01 | 28.21 | 47.64 | 46.10 | 40.92 | 40.42 | 38.03 |
| Ta2O5 | 25.57 | 24.41 | 24.83 | 23.83 | 60.64 | 57.63 | 55.53 | 53.94 | 32.85 | 33.93 | 39.71 | 39.32 | 42.30 |
| SnO2 | 0.43 | 0.32 | 0.44 | 0.24 | 0.59 | 0.32 | 0.19 | 0.28 | 0.61 | 0.53 | 0.44 | 0.43 | 0.44 |
| WO3 | 1.11 | 1.10 | 1.11 | 1.02 | 1.13 | 1.10 | 0.10 | 0.22 | 0.19 | 0.21 | 0.16 | 0.13 | 0.22 |
| PbO | 0.24 | 0.24 | 0.24 | 0.24 | 0.00 | 0.00 | 0.10 | 0.12 | 0.14 | 0.15 | 0.15 | 0.27 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.39 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.23 | 0.28 | 0.28 | 0.29 | 0.08 | 0.22 | 0.00 | 0.00 | 0.12 | 0.04 | 0.00 | 0.04 | 0.11 |
| CaO | 0.01 | 0.00 | 0.02 | 0.01 | | | 0.03 | 0.01 | 0.06 | 0.05 | 0.06 | 0.01 | 0.06 |
| Total | 99.37 | 99.76 | 99.07 | 100.38 | 100.08 | 100.34 | 98.44 | 99.21 | 99.82 | 99.07 | 98.94 | 98.47 | 98.54 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.411 | 0.393 | 0.333 | 0.408 | 0.264 | 0.324 | 0.528 | 0.543 | 0.381 | 0.390 | 0.461 | 0.481 | 0.403 |
| Mn | 0.537 | 0.562 | 0.619 | 0.540 | 0.689 | 0.631 | 0.445 | 0.415 | 0.585 | 0.580 | 0.466 | 0.469 | 0.556 |
| Ti | 0.092 | 0.078 | 0.108 | 0.076 | 0.053 | 0.070 | 0.039 | 0.034 | 0.025 | 0.026 | 0.055 | 0.059 | 0.036 |
| Nb | 1.471 | 1.504 | 1.468 | 1.526 | 0.714 | 0.780 | 0.863 | 0.919 | 1.393 | 1.367 | 1.243 | 1.235 | 1.179 |
| Ta | 0.436 | 0.413 | 0.423 | 0.399 | 1.219 | 1.137 | 1.108 | 1.057 | 0.578 | 0.605 | 0.726 | 0.723 | 0.789 |
| Sn | 0.011 | 0.008 | 0.011 | 0.006 | 0.018 | 0.009 | 0.006 | 0.008 | 0.016 | 0.014 | 0.012 | 0.012 | 0.012 |
| W | 0.018 | 0.018 | 0.018 | 0.016 | 0.022 | 0.021 | 0.002 | 0.004 | 0.003 | 0.003 | 0.003 | 0.002 | 0.004 |
| Pb | 0.004 | 0.004 | 0.004 | 0.004 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.005 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.013 | 0.015 | 0.015 | 0.016 | 0.005 | 0.014 | 0.000 | 0.000 | 0.007 | 0.002 | 0.000 | 0.002 | 0.007 |
| Ca | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.004 | 0.003 | 0.004 | 0.001 | 0.004 |
| Total | 2.994 | 2.995 | 3.001 | 2.991 | 2.984 | 2.992 | 2.995 | 2.984 | 2.993 | 2.993 | 2.973 | 2.988 | 2.990 |
| Mn/(Mn+Fe) | 0.566 | 0.588 | 0.650 | 0.570 | 0.723 | 0.661 | 0.458 | 0.434 | 0.605 | 0.598 | 0.503 | 0.494 | 0.580 |
| Ta/(Ta+Nb) | 0.229 | 0.215 | 0.224 | 0.207 | 0.630 | 0.593 | 0.562 | 0.535 | 0.293 | 0.307 | 0.369 | 0.369 | 0.401 |
| Comments: | | PA & PD same grain | | | isolated grains associated with wodginite/microlite | | incl. in cass. | incl. in cass. | | QD - QH same grain<br>QD & QH core | | | |

**East Beryl pegmatite**

97-1A

| | NF1 | NF2 | NF3 | NF4 | NF5 | NF6 | NF7 | NF8 | NF9 | NF10 |
|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 0.46 | 1.35 | 1.49 | 2.14 | 1.28 | 1.40 | 1.30 | 1.42 | 2.02 | 2.06 |
| MnO | 14.31 | 13.86 | 13.73 | 13.07 | 13.93 | 13.90 | 13.87 | 13.77 | 13.34 | 13.37 |
| TiO2 | 0.00 | 0.05 | 0.10 | 0.04 | 0.04 | 0.06 | 0.00 | 0.02 | 0.02 | 0.08 |
| Nb2O5 | 14.69 | 17.60 | 17.57 | 17.71 | 18.07 | 17.99 | 17.24 | 17.83 | 19.03 | 19.44 |
| Ta2O5 | 69.20 | 66.14 | 65.49 | 65.68 | 65.71 | 65.73 | 66.35 | 65.63 | 64.56 | 64.30 |
| SnO2 | 0.03 | 0.07 | 0.06 | 0.09 | 0.04 | 0.16 | 0.06 | 0.02 | 0.04 | 0.05 |
| WO3 | 0.35 | 0.41 | 0.37 | 0.55 | 0.43 | 0.49 | 0.58 | 0.43 | 0.45 | 0.46 |
| PbO | 0.03 | 0.08 | 0.13 | 0.04 | 0.02 | 0.03 | 0.05 | 0.00 | 0.14 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.05 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.01 | 0.00 | 0.00 | 0.14 | 0.06 | 0.00 | 0.00 | 0.06 | 0.18 | 0.10 |
| CaO | 0.01 | 0.01 | 0.03 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.01 |
| Total | 99.11 | 99.62 | 98.99 | 99.46 | 99.59 | 99.78 | 99.56 | 99.21 | 99.77 | 99.86 |

**Structural formulae based on 6 oxygens**

| | NF1 | NF2 | NF3 | NF4 | NF5 | NF6 | NF7 | NF8 | NF9 | NF10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.030 | 0.086 | 0.096 | 0.137 | 0.082 | 0.090 | 0.083 | 0.091 | 0.128 | 0.130 |
| Mn | 0.951 | 0.900 | 0.896 | 0.849 | 0.902 | 0.899 | 0.904 | 0.896 | 0.857 | 0.856 |
| Ti | 0.000 | 0.003 | 0.006 | 0.002 | 0.002 | 0.003 | 0.000 | 0.001 | 0.001 | 0.004 |
| Nb | 0.521 | 0.610 | 0.612 | 0.614 | 0.625 | 0.621 | 0.600 | 0.619 | 0.653 | 0.664 |
| Ta | 1.476 | 1.379 | 1.373 | 1.369 | 1.366 | 1.365 | 1.388 | 1.371 | 1.332 | 1.322 |
| Sn | 0.001 | 0.002 | 0.002 | 0.003 | 0.001 | 0.005 | 0.002 | 0.001 | 0.001 | 0.001 |
| W | 0.007 | 0.008 | 0.007 | 0.011 | 0.008 | 0.010 | 0.012 | 0.009 | 0.009 | 0.009 |
| Pb | 0.001 | 0.002 | 0.003 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.003 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.001 | 0.000 | 0.000 | 0.009 | 0.004 | 0.000 | 0.000 | 0.004 | 0.012 | 0.007 |
| Ca | 0.001 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 |
| Total | 2.989 | 2.993 | 2.999 | 2.995 | 2.991 | 2.994 | 2.992 | 2.993 | 2.997 | 2.994 |
| | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.969 | 0.913 | 0.903 | 0.861 | 0.917 | 0.909 | 0.916 | 0.907 | 0.870 | 0.868 |
| Ta/(Ta+Nb) | 0.739 | 0.693 | 0.692 | 0.691 | 0.686 | 0.687 | 0.698 | 0.689 | 0.671 | 0.666 |
| Comments: | | | | | contains wodginite inclusion | | | | | |
| | 93-265 locality | | | | | | | | | |

**East Beryl pegmatite**

97-1A

| | NC1 | NC2 | NC3 | NC4 | NC5 | NC6 | NC7 | NC8 | ND1 | ND2 |
|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 1.76 | 1.26 | 2.75 | 1.26 | 1.36 | 1.34 | 1.44 | 1.53 | 1.00 | 1.05 |
| MnO | 12.57 | 13.25 | 12.23 | 13.26 | 13.41 | 13.56 | 13.19 | 12.97 | 13.63 | 13.46 |
| TiO2 | 0.05 | 0.04 | 0.00 | 0.08 | 0.04 | 0.09 | 0.12 | 0.12 | 0.07 | 0.04 |
| Nb2O5 | 17.28 | 16.96 | 18.78 | 17.85 | 18.11 | 18.16 | 17.81 | 19.14 | 16.72 | 16.03 |
| Ta2O5 | 67.08 | 67.82 | 66.43 | 67.19 | 66.93 | 66.88 | 67.11 | 65.74 | 68.12 | 68.96 |
| SnO2 | 0.07 | 0.13 | 0.05 | 0.02 | 0.05 | 0.03 | 0.06 | 0.03 | 0.06 | 0.00 |
| WO3 | 0.46 | 0.54 | 0.39 | 0.32 | 0.33 | 0.40 | 0.38 | 0.35 | 0.29 | 0.30 |
| PbO | 0.01 | 0.00 | 0.04 | 0.07 | 0.03 | 0.01 | 0.09 | 0.04 | 0.05 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.08 | 0.03 | 0.00 | 0.00 | 0.09 | 0.08 | 0.00 | 0.10 | 0.03 |
| CaO | 0.02 | 0.02 | 0.01 | 0.01 | 0.03 | 0.01 | 0.21 | 0.01 | 0.03 | 0.03 |
| Total | 99.30 | 100.12 | 100.72 | 100.06 | 100.28 | 100.57 | 100.50 | 99.92 | 100.07 | 99.96 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.114 | 0.081 | 0.174 | 0.080 | 0.086 | 0.085 | 0.092 | 0.097 | 0.064 | 0.068 |
| Mn | 0.822 | 0.860 | 0.782 | 0.858 | 0.864 | 0.870 | 0.849 | 0.833 | 0.887 | 0.881 |
| Ti | 0.003 | 0.002 | 0.000 | 0.005 | 0.002 | 0.005 | 0.007 | 0.007 | 0.004 | 0.002 |
| Nb | 0.603 | 0.588 | 0.641 | 0.617 | 0.623 | 0.622 | 0.612 | 0.656 | 0.580 | 0.560 |
| Ta | 1.407 | 1.414 | 1.364 | 1.396 | 1.385 | 1.378 | 1.386 | 1.356 | 1.422 | 1.449 |
| Sn | 0.002 | 0.004 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.000 |
| W | 0.009 | 0.011 | 0.008 | 0.006 | 0.007 | 0.008 | 0.007 | 0.007 | 0.006 | 0.006 |
| Pb | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.005 | 0.002 | 0.000 | 0.000 | 0.006 | 0.005 | 0.000 | 0.007 | 0.002 |
| Ca | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.017 | 0.001 | 0.002 | 0.002 |
| Total | 2.961 | 2.967 | 2.974 | 2.964 | 2.971 | 2.976 | 2.978 | 2.959 | 2.975 | 2.971 |
| Mn/(Mn+Fe) | 0.878 | 0.914 | 0.818 | 0.914 | 0.909 | 0.911 | 0.903 | 0.896 | 0.932 | 0.928 |
| Ta/(Ta+Nb) | 0.700 | 0.706 | 0.680 | 0.694 | 0.690 | 0.689 | 0.694 | 0.674 | 0.710 | 0.721 |

Comments: unzoned and apparently homogeneous
apart from dark (BSE) regions along fracture lines

## Columbite-Tantalite Group

| | East Beryl pegmatite | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-1A | | | | | | | | | | | | | |
| | ND3 | ND4 | ND5 | ND6 | ND7 | ND8 | NE1 | NE2 | NE3 | NE4 | NE5 | NE6 | NE7 | NE8 |
| FeO | 0.50 | 0.44 | 0.44 | 1.34 | 4.15 | 1.14 | 3.99 | 3.40 | 2.88 | 3.41 | 3.70 | 5.61 | 4.00 | 3.29 |
| MnO | 13.83 | 14.07 | 14.24 | 13.06 | 10.28 | 13.63 | 13.38 | 14.21 | 14.18 | 13.88 | 13.71 | 12.22 | 13.69 | 14.19 |
| TiO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.30 | 0.28 | 0.08 | 0.15 | 0.16 | 0.29 | 0.32 | 0.21 |
| Nb2O5 | 14.63 | 16.18 | 16.57 | 17.25 | 16.80 | 21.35 | 48.58 | 52.20 | 44.92 | 49.10 | 48.61 | 51.96 | 52.53 | 52.42 |
| Ta2O5 | 70.54 | 69.29 | 68.48 | 67.83 | 67.71 | 63.35 | 31.76 | 28.39 | 36.91 | 32.32 | 32.98 | 28.58 | 28.01 | 28.57 |
| SnO2 | 0.04 | 0.05 | 0.11 | 0.06 | 0.07 | 0.05 | 0.07 | 0.05 | 0.07 | 0.05 | 0.08 | 0.07 | 0.01 | 0.03 |
| WO3 | 0.24 | 0.25 | 0.27 | 0.42 | 0.42 | 0.36 | 0.80 | 0.68 | 0.36 | 0.42 | 0.46 | 0.95 | 0.83 | 0.72 |
| PbO | 0.02 | 0.06 | 0.02 | 0.04 | 0.10 | 0.07 | 0.29 | 0.26 | 0.19 | 0.29 | 0.17 | 0.21 | 0.21 | 0.30 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.02 | 0.00 | 0.01 | 0.04 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 | 0.00 | 0.08 |
| CaO | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.04 | 0.02 | 0.03 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.02 |
| Total | 99.82 | 100.42 | 100.13 | 100.06 | 99.59 | 100.07 | 99.20 | 99.48 | 99.59 | 99.67 | 99.89 | 99.89 | 99.60 | 99.84 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.033 | 0.028 | 0.028 | 0.086 | 0.268 | 0.071 | 0.217 | 0.181 | 0.159 | 0.184 | 0.200 | 0.298 | 0.212 | 0.175 |
| Mn | 0.915 | 0.916 | 0.927 | 0.848 | 0.673 | 0.864 | 0.736 | 0.766 | 0.793 | 0.760 | 0.751 | 0.657 | 0.736 | 0.763 |
| Ti | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.015 | 0.013 | 0.004 | 0.007 | 0.008 | 0.014 | 0.015 | 0.010 |
| Nb | 0.516 | 0.562 | 0.576 | 0.598 | 0.587 | 0.722 | 1.426 | 1.502 | 1.342 | 1.435 | 1.421 | 1.492 | 1.507 | 1.504 |
| Ta | 1.497 | 1.449 | 1.432 | 1.415 | 1.423 | 1.289 | 0.561 | 0.491 | 0.663 | 0.568 | 0.580 | 0.494 | 0.483 | 0.493 |
| Sn | 0.001 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.000 | 0.001 |
| W | 0.005 | 0.005 | 0.005 | 0.008 | 0.008 | 0.007 | 0.013 | 0.011 | 0.006 | 0.007 | 0.008 | 0.016 | 0.014 | 0.012 |
| Pb | 0.000 | 0.001 | 0.000 | 0.001 | 0.002 | 0.001 | 0.005 | 0.004 | 0.003 | 0.005 | 0.003 | 0.004 | 0.004 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.005 |
| Ca | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.003 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 |
| Total | 2.968 | 2.969 | 2.974 | 2.960 | 2.966 | 2.965 | 2.976 | 2.972 | 2.974 | 2.971 | 2.974 | 2.975 | 2.972 | 2.968 |
| Mn/(Mn+Fe) | 0.966 | 0.970 | 0.970 | 0.908 | 0.715 | 0.924 | 0.772 | 0.809 | 0.833 | 0.805 | 0.789 | 0.688 | 0.776 | 0.814 |
| Ta/(Ta+Nb) | 0.744 | 0.720 | 0.713 | 0.703 | 0.708 | 0.641 | 0.282 | 0.246 | 0.331 | 0.284 | 0.290 | 0.249 | 0.243 | 0.247 |
| Comments: | | insurgent patchy zoning at fractures<br>weak oscillatory zoning elsewhere | | | | | | | wispy patchy zoning in a band across the traverse<br>rest of grain is unzoned | | | | | |

## Columbite-Tantalite Group

| | SW Beryl pegmatite | | | | | SW Beryl pegmatite | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-10A | | | | | 97-16B | | | | | | |
| | CA | MA | MB | MC | ME | EA | EB | EC | ED | EI | EJ | EK |
| FeO | 5.20 | 5.53 | 5.46 | 5.48 | 6.39 | 10.95 | 11.88 | 11.15 | 10.94 | 11.17 | 11.59 | 12.26 |
| MnO | 10.44 | 9.78 | 8.95 | 9.06 | 8.72 | 4.40 | 4.91 | 4.33 | 4.23 | 4.61 | 4.71 | 5.02 |
| TiO2 | 0.07 | 0.17 | 0.11 | 0.08 | 0.40 | 0.41 | 0.37 | 0.37 | 0.50 | 0.45 | 0.37 | 0.25 |
| Nb2O5 | 21.58 | 22.30 | 14.26 | 15.79 | 13.70 | 26.60 | 42.89 | 27.49 | 24.41 | 34.05 | 36.40 | 42.73 |
| Ta2O5 | 62.08 | 60.56 | 70.07 | 68.54 | 69.62 | 55.26 | 37.07 | 55.04 | 58.16 | 46.47 | 44.72 | 38.67 |
| SnO2 | 0.16 | 0.10 | 0.18 | 0.12 | 0.17 | 0.83 | 0.13 | 0.14 | 0.29 | 0.18 | 0.22 | 0.06 |
| WO3 | 0.22 | 0.19 | 0.19 | 0.24 | 0.20 | 0.47 | 0.46 | 0.50 | 0.48 | 0.51 | 0.55 | 0.39 |
| PbO | 0.07 | 0.09 | 0.03 | 0.07 | 0.06 | 0.10 | 0.22 | 0.12 | 0.09 | 0.22 | 0.13 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.16 | 0.02 | 0.00 | 0.12 | 0.01 | 0.00 | 0.02 | 0.07 | 0.05 | 0.10 | 0.00 |
| CaO | 0.03 | 0.02 | 0.01 | 0.01 | 0.06 | 0.03 | 0.09 | 0.03 | 0.09 | 0.42 | 0.42 | 0.02 |
| Total | 99.85 | 98.90 | 99.27 | 99.39 | 99.42 | 99.06 | 98.06 | 99.18 | 99.26 | 98.15 | 99.23 | 99.58 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.325 | 0.347 | 0.358 | 0.357 | 0.418 | 0.668 | 0.670 | 0.677 | 0.674 | 0.658 | 0.668 | 0.684 |
| Mn | 0.661 | 0.621 | 0.595 | 0.597 | 0.578 | 0.272 | 0.281 | 0.266 | 0.264 | 0.275 | 0.275 | 0.284 |
| Ti | 0.004 | 0.010 | 0.006 | 0.005 | 0.023 | 0.022 | 0.019 | 0.020 | 0.028 | 0.024 | 0.019 | 0.013 |
| Nb | 0.729 | 0.756 | 0.506 | 0.555 | 0.485 | 0.877 | 1.308 | 0.903 | 0.813 | 1.085 | 1.135 | 1.290 |
| Ta | 1.262 | 1.235 | 1.497 | 1.450 | 1.482 | 1.096 | 0.680 | 1.087 | 1.165 | 0.891 | 0.839 | 0.702 |
| Sn | 0.005 | 0.003 | 0.006 | 0.004 | 0.005 | 0.024 | 0.004 | 0.004 | 0.009 | 0.005 | 0.006 | 0.001 |
| W | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 | 0.009 | 0.008 | 0.009 | 0.009 | 0.009 | 0.010 | 0.007 |
| Pb | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.004 | 0.002 | 0.002 | 0.004 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.011 | 0.001 | 0.000 | 0.008 | 0.001 | 0.000 | 0.001 | 0.004 | 0.003 | 0.006 | 0.000 |
| Ca | 0.003 | 0.002 | 0.001 | 0.000 | 0.005 | 0.003 | 0.007 | 0.002 | 0.007 | 0.032 | 0.031 | 0.001 |
| Total | 2.995 | 2.989 | 2.975 | 2.974 | 3.010 | 2.974 | 2.980 | 2.972 | 2.975 | 2.987 | 2.992 | 2.985 |
| Mn/(Mn+Fe) | 0.670 | 0.642 | 0.624 | 0.626 | 0.580 | 0.289 | 0.295 | 0.282 | 0.281 | 0.295 | 0.292 | 0.293 |
| Ta/(Ta+Nb) | 0.634 | 0.620 | 0.747 | 0.723 | 0.754 | 0.555 | 0.342 | 0.546 | 0.589 | 0.451 | 0.425 | 0.352 |
| Comments: | | MA - MC<br>same grain<br>core | | | | EA & EB<br>same grain | | EC & ED<br>same grain | | EI - EK<br>same grain<br>patchy zoned | | |

## Columbite-Tantalite Group

| | **School of Fish pegmatite** | | | | | | | **SW Beryl pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-70 | | | | | | | 97-134A | | | | | |
| | EA | EI | EJ | EC | EE | EF | EH | DA | DB | DC | DD | DE | PF |
| FeO | 7.40 | 5.67 | 5.87 | 11.08 | 11.41 | 10.09 | 11.27 | 17.16 | 17.25 | 16.04 | 16.51 | 15.91 | 16.17 |
| MnO | 10.20 | 11.17 | 10.65 | 6.48 | 6.92 | 6.07 | 6.70 | 2.81 | 2.67 | 3.46 | 3.65 | 3.53 | 3.59 |
| TiO2 | 0.42 | 0.35 | 0.29 | 0.69 | 0.71 | 0.28 | 0.64 | 0.52 | 0.48 | 0.41 | 0.52 | 0.64 | 0.37 |
| Nb2O5 | 58.06 | 51.89 | 48.35 | 56.10 | 62.33 | 42.91 | 62.17 | 65.89 | 66.30 | 60.91 | 67.05 | 61.83 | 63.01 |
| Ta2O5 | 21.29 | 28.93 | 32.34 | 22.80 | 15.33 | 37.44 | 16.21 | 11.42 | 11.35 | 17.86 | 10.76 | 15.92 | 15.69 |
| SnO2 | 0.00 | 0.03 | 0.03 | 0.12 | 0.17 | 0.05 | 0.12 | 0.11 | 0.09 | 0.10 | 0.04 | 0.13 | 0.06 |
| WO3 | 0.54 | 0.35 | 0.37 | 0.33 | 0.34 | 0.42 | 0.27 | 0.44 | 0.36 | 0.52 | 0.39 | 0.55 | 0.47 |
| PbO | 0.30 | 0.24 | 0.23 | 0.24 | 0.32 | 0.14 | 0.32 | 0.33 | 0.33 | 0.30 | 0.35 | 0.35 | 0.33 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.21 | 0.21 | 0.01 | 0.17 | 0.14 | 0.01 | 0.00 | 0.08 | 0.02 | 0.08 |
| CaO | 0.06 | 0.09 | 0.12 | 0.02 | 0.01 | 0.06 | 0.03 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 |
| Total | 98.25 | 98.73 | 98.25 | 98.08 | 97.74 | 97.46 | 97.87 | 98.84 | 98.84 | 99.61 | 99.36 | 98.86 | 99.77 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.386 | 0.304 | 0.322 | 0.583 | 0.583 | 0.572 | 0.577 | 0.857 | 0.861 | 0.817 | 0.817 | 0.810 | 0.815 |
| Mn | 0.539 | 0.607 | 0.591 | 0.345 | 0.359 | 0.349 | 0.347 | 0.142 | 0.135 | 0.179 | 0.183 | 0.182 | 0.183 |
| Ti | 0.020 | 0.017 | 0.014 | 0.032 | 0.033 | 0.014 | 0.029 | 0.023 | 0.022 | 0.019 | 0.023 | 0.029 | 0.017 |
| Nb | 1.639 | 1.505 | 1.433 | 1.595 | 1.723 | 1.316 | 1.721 | 1.779 | 1.789 | 1.677 | 1.795 | 1.701 | 1.716 |
| Ta | 0.361 | 0.505 | 0.577 | 0.390 | 0.255 | 0.691 | 0.270 | 0.186 | 0.184 | 0.296 | 0.173 | 0.263 | 0.257 |
| Sn | 0.000 | 0.001 | 0.001 | 0.003 | 0.004 | 0.001 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.003 | 0.001 |
| W | 0.009 | 0.006 | 0.006 | 0.005 | 0.005 | 0.007 | 0.004 | 0.007 | 0.006 | 0.008 | 0.006 | 0.009 | 0.007 |
| Pb | 0.005 | 0.004 | 0.004 | 0.004 | 0.005 | 0.003 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.006 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.012 | 0.011 | 0.001 | 0.009 | 0.007 | 0.001 | 0.000 | 0.004 | 0.001 | 0.004 |
| Ca | 0.004 | 0.006 | 0.008 | 0.002 | 0.001 | 0.005 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 |
| Total | 2.963 | 2.955 | 2.957 | 2.971 | 2.979 | 2.959 | 2.968 | 3.010 | 3.005 | 3.003 | 3.009 | 3.003 | 3.006 |
| Mn/(Mn+Fe) | 0.583 | 0.666 | 0.648 | 0.372 | 0.381 | 0.379 | 0.376 | 0.142 | 0.136 | 0.179 | 0.183 | 0.183 | 0.184 |
| Ta/(Ta+Nb) | 0.181 | 0.251 | 0.287 | 0.196 | 0.129 | 0.344 | 0.136 | 0.094 | 0.093 | 0.150 | 0.088 | 0.134 | 0.130 |
| Comments: | | EI & EJ same grain | | from veinlet | from veinlet | from veinlet | from veinlet | DA & DB same grain | | DC - DE same grain | | | |
| | main part of sample is a different composition from veinlet | | | | | | | from cluster of columbite and cassiterite grains | | | | | |

| | SW Beryl pegmatite | | | | | | Big Whopper pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-134A | | | | | | 97-185A | | | | |
| | PG | PH | PI | PJ | PL | PM | DA | DB | DH | DI | DJ |
| FeO | 16.03 | 14.59 | 15.92 | 14.51 | 14.67 | 16.01 | 14.57 | 14.13 | 14.59 | 14.44 | 13.49 |
| MnO | 3.54 | 3.20 | 3.63 | 3.12 | 3.16 | 3.52 | 5.33 | 5.72 | 5.55 | 5.61 | 5.82 |
| TiO2 | 0.41 | 0.42 | 0.35 | 0.42 | 0.40 | 0.41 | 0.67 | 0.72 | 0.65 | 0.74 | 0.53 |
| Nb2O5 | 61.41 | 41.61 | 60.71 | 41.55 | 41.72 | 62.28 | 68.37 | 66.59 | 68.90 | 68.59 | 60.07 |
| Ta2O5 | 16.85 | 39.17 | 17.67 | 38.64 | 38.10 | 16.16 | 10.31 | 12.22 | 9.86 | 10.25 | 19.04 |
| SnO2 | 0.08 | 0.10 | 0.04 | 0.06 | 0.14 | 0.06 | 0.01 | 0.06 | 0.08 | 0.06 | 0.04 |
| WO3 | 0.48 | 0.48 | 0.40 | 0.39 | 0.39 | 0.48 | 0.64 | 0.47 | 0.58 | 0.55 | 0.73 |
| PbO | 0.32 | 0.20 | 0.28 | 0.20 | 0.19 | 0.28 | 0.35 | 0.32 | 0.35 | 0.35 | 0.30 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.13 | 0.17 | 0.15 | 0.19 | 0.21 | 0.07 |
| CaO | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 |
| Total | 99.12 | 99.78 | 98.99 | 98.99 | 98.79 | 99.33 | 100.42 | 100.36 | 100.76 | 100.78 | 100.09 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.817 | 0.816 | 0.815 | 0.816 | 0.826 | 0.811 | 0.711 | 0.695 | 0.709 | 0.702 | 0.686 |
| Mn | 0.183 | 0.181 | 0.188 | 0.178 | 0.180 | 0.180 | 0.264 | 0.285 | 0.273 | 0.276 | 0.300 |
| Ti | 0.019 | 0.021 | 0.016 | 0.021 | 0.020 | 0.019 | 0.029 | 0.032 | 0.028 | 0.032 | 0.024 |
| Nb | 1.693 | 1.258 | 1.681 | 1.264 | 1.270 | 1.706 | 1.804 | 1.771 | 1.809 | 1.802 | 1.652 |
| Ta | 0.279 | 0.712 | 0.294 | 0.707 | 0.698 | 0.266 | 0.164 | 0.195 | 0.156 | 0.162 | 0.315 |
| Sn | 0.002 | 0.003 | 0.001 | 0.002 | 0.004 | 0.001 | 0.000 | 0.001 | 0.002 | 0.001 | 0.001 |
| W | 0.008 | 0.008 | 0.006 | 0.007 | 0.007 | 0.008 | 0.010 | 0.007 | 0.009 | 0.008 | 0.011 |
| Pb | 0.005 | 0.004 | 0.005 | 0.004 | 0.003 | 0.005 | 0.005 | 0.005 | 0.006 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.007 | 0.009 | 0.007 | 0.010 | 0.011 | 0.004 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.006 | 3.004 | 3.007 | 3.004 | 3.010 | 3.003 | 2.995 | 2.999 | 3.001 | 2.999 | 2.999 |
| Mn/(Mn+Fe) | 0.183 | 0.182 | 0.187 | 0.179 | 0.179 | 0.182 | 0.270 | 0.291 | 0.278 | 0.282 | 0.304 |
| Ta/(Ta+Nb) | 0.142 | 0.362 | 0.149 | 0.359 | 0.355 | 0.135 | 0.083 | 0.099 | 0.079 | 0.082 | 0.160 |
| Comments: | | PF - PJ<br>same grain | | PL & PM<br>same grain | | | DA & DB<br>same grain<br>core rim | | | DH & DI<br>same grain | |

## Columbite-Tantalite Group

| | | | | | **Big Whopper** | | | | | | | | **Big Whopper peg.** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 97-185A | | | | | | | | 97-185B | |
| | DK | DL | DM | DN | DO | DP | DQ | DR | DS | DT | DU | AA | AB | AC |
| FeO | 14.13 | 13.47 | 14.05 | 14.18 | 14.34 | 13.79 | 13.91 | 13.64 | 14.26 | 14.17 | 14.36 | 7.46 | 6.41 | 7.74 |
| MnO | 5.78 | 5.76 | 5.87 | 5.76 | 5.80 | 5.45 | 6.02 | 5.66 | 5.77 | 5.94 | 5.70 | 10.02 | 8.26 | 10.53 |
| TiO2 | 0.58 | 0.41 | 0.73 | 0.71 | 0.77 | 0.83 | 0.77 | 0.54 | 0.80 | 0.62 | 0.66 | 0.58 | 0.00 | 0.33 |
| Nb2O5 | 67.57 | 58.56 | 66.84 | 66.77 | 69.50 | 57.62 | 66.51 | 60.07 | 67.78 | 68.08 | 68.19 | 44.31 | 12.29 | 51.25 |
| Ta2O5 | 10.96 | 21.08 | 11.16 | 12.01 | 8.44 | 21.32 | 11.83 | 18.82 | 10.72 | 10.72 | 10.43 | 36.12 | 72.28 | 28.63 |
| SnO2 | 0.08 | 0.07 | 0.09 | 0.04 | 0.03 | 0.13 | 0.13 | 0.07 | 0.02 | 0.12 | 0.05 | 0.26 | 0.26 | 0.13 |
| WO3 | 0.50 | 0.61 | 0.72 | 0.71 | 0.83 | 1.09 | 0.61 | 0.94 | 0.75 | 0.68 | 0.37 | 0.71 | 0.11 | 0.68 |
| PbO | 0.31 | 0.29 | 0.31 | 0.34 | 0.35 | 0.30 | 0.32 | 0.26 | 0.31 | 0.35 | 0.34 | 0.29 | 0.05 | 0.30 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.14 | 0.01 | 0.07 | 0.09 | 0.19 | 0.00 | 0.00 | 0.00 | 0.21 | 0.15 | 0.07 | 0.00 | 0.03 | 0.00 |
| CaO | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.03 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 | 0.04 | 0.03 |
| Total | 100.07 | 100.26 | 99.86 | 100.60 | 100.25 | 100.54 | 100.12 | 100.01 | 100.62 | 100.83 | 100.17 | 99.76 | 99.73 | 99.62 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.694 | 0.690 | 0.693 | 0.696 | 0.696 | 0.706 | 0.685 | 0.694 | 0.695 | 0.690 | 0.703 | 0.411 | 0.424 | 0.413 |
| Mn | 0.288 | 0.299 | 0.293 | 0.286 | 0.285 | 0.283 | 0.301 | 0.292 | 0.285 | 0.293 | 0.283 | 0.559 | 0.554 | 0.569 |
| Ti | 0.026 | 0.019 | 0.032 | 0.031 | 0.034 | 0.038 | 0.034 | 0.025 | 0.035 | 0.027 | 0.029 | 0.029 | 0.000 | 0.016 |
| Nb | 1.794 | 1.622 | 1.781 | 1.772 | 1.824 | 1.594 | 1.772 | 1.653 | 1.787 | 1.793 | 1.805 | 1.320 | 0.440 | 1.479 |
| Ta | 0.175 | 0.351 | 0.179 | 0.192 | 0.133 | 0.355 | 0.190 | 0.311 | 0.170 | 0.170 | 0.166 | 0.647 | 1.557 | 0.497 |
| Sn | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.003 | 0.003 | 0.002 | 0.000 | 0.003 | 0.001 | 0.007 | 0.008 | 0.003 |
| W | 0.008 | 0.010 | 0.011 | 0.011 | 0.013 | 0.017 | 0.009 | 0.015 | 0.011 | 0.010 | 0.006 | 0.012 | 0.002 | 0.011 |
| Pb | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.005 | 0.001 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.007 | 0.001 | 0.004 | 0.004 | 0.009 | 0.000 | 0.000 | 0.000 | 0.010 | 0.008 | 0.004 | 0.000 | 0.002 | 0.000 |
| Ca | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.004 | 0.002 |
| Total | 3.000 | 2.999 | 3.001 | 2.999 | 3.000 | 3.001 | 3.001 | 2.997 | 3.001 | 3.001 | 3.001 | 2.990 | 2.992 | 2.995 |
| Mn/(Mn+Fe) | 0.293 | 0.302 | 0.297 | 0.291 | 0.291 | 0.286 | 0.305 | 0.296 | 0.291 | 0.298 | 0.287 | 0.577 | 0.566 | 0.579 |
| Ta/(Ta+Nb) | 0.089 | 0.178 | 0.091 | 0.098 | 0.068 | 0.182 | 0.097 | 0.159 | 0.087 | 0.086 | 0.084 | 0.329 | 0.780 | 0.252 |
| Comments: | close association of columbite with monazite & xenotime in this sample | | | | | | | | | | | | AA - AC | |
| | | | | | | | | | | | | | same grain | |
| | | | | | | | | | | | | core? | mid | rim |

| | **Big Whopper pegmatite** | | | | | **Big Whopper pegmatite** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-185B | | | | | 97-186A | | | | | | | | | |
| | AD | AE | AF | AG | AL | DB | DD | DE | DF | DH | DI | DJ | DK | DL | HA |
| FeO | 6.55 | 6.32 | 7.71 | 8.07 | 7.95 | 8.56 | 10.28 | 11.09 | 11.30 | 10.44 | 9.93 | 11.27 | 10.70 | 10.08 | 8.36 |
| MnO | 8.56 | 8.42 | 10.58 | 10.31 | 10.43 | 5.03 | 5.29 | 6.43 | 6.27 | 6.28 | 5.90 | 6.39 | 6.58 | 6.04 | 6.64 |
| TiO2 | 0.00 | 0.01 | 0.29 | 0.23 | 0.41 | 0.58 | 1.26 | 0.35 | 0.30 | 0.12 | 0.29 | 0.25 | 0.20 | 0.44 | 0.00 |
| Nb2O5 | 16.38 | 15.15 | 50.42 | 51.93 | 51.72 | 26.65 | 24.51 | 44.74 | 47.83 | 35.57 | 25.44 | 46.35 | 40.72 | 28.40 | 21.20 |
| Ta2O5 | 67.64 | 68.35 | 29.39 | 28.37 | 28.13 | 54.16 | 54.88 | 35.58 | 32.06 | 46.05 | 56.99 | 34.17 | 40.16 | 53.73 | 63.71 |
| SnO2 | 0.12 | 0.07 | 0.07 | 0.11 | 0.15 | 0.61 | 0.99 | 0.10 | 0.12 | 0.12 | 0.13 | 0.07 | 0.06 | 0.12 | 0.19 |
| WO3 | 0.12 | 0.15 | 0.65 | 0.61 | 0.57 | 0.50 | 1.24 | 0.43 | 0.38 | 0.27 | 0.35 | 0.46 | 0.33 | 0.69 | 0.23 |
| PbO | 0.06 | 0.04 | 0.21 | 0.27 | 0.26 | 0.14 | 0.09 | 0.21 | 0.21 | 0.10 | 0.12 | 0.24 | 0.19 | 0.12 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.15 | 0.07 | 0.15 | 0.00 | 0.00 | 0.19 | 0.11 | 0.01 | 0.06 | 0.03 | 0.00 | 0.05 | 0.00 | 0.04 | 0.01 |
| CaO | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 | 2.22 | 0.00 | 0.00 | 0.02 | 0.02 | 0.04 | 0.03 | 0.03 | 0.01 | 0.04 |
| Total | 99.57 | 98.66 | 99.47 | 99.91 | 99.62 | 98.64 | 98.66 | 98.94 | 98.54 | 99.00 | 99.19 | 99.28 | 98.97 | 99.67 | 100.42 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.423 | 0.415 | 0.413 | 0.429 | 0.423 | 0.519 | 0.630 | 0.615 | 0.619 | 0.608 | 0.610 | 0.619 | 0.606 | 0.605 | 0.523 |
| Mn | 0.560 | 0.561 | 0.574 | 0.555 | 0.562 | 0.309 | 0.328 | 0.361 | 0.348 | 0.370 | 0.367 | 0.355 | 0.377 | 0.367 | 0.420 |
| Ti | 0.000 | 0.001 | 0.014 | 0.011 | 0.020 | 0.032 | 0.069 | 0.017 | 0.015 | 0.006 | 0.016 | 0.012 | 0.010 | 0.024 | 0.000 |
| Nb | 0.572 | 0.538 | 1.461 | 1.491 | 1.488 | 0.873 | 0.812 | 1.341 | 1.416 | 1.120 | 0.845 | 1.376 | 1.248 | 0.922 | 0.716 |
| Ta | 1.422 | 1.460 | 0.512 | 0.490 | 0.487 | 1.068 | 1.093 | 0.642 | 0.571 | 0.872 | 1.138 | 0.610 | 0.740 | 1.049 | 1.295 |
| Sn | 0.004 | 0.002 | 0.002 | 0.003 | 0.004 | 0.017 | 0.029 | 0.003 | 0.003 | 0.003 | 0.004 | 0.002 | 0.002 | 0.003 | 0.006 |
| W | 0.002 | 0.003 | 0.011 | 0.010 | 0.009 | 0.009 | 0.024 | 0.007 | 0.006 | 0.005 | 0.007 | 0.008 | 0.006 | 0.013 | 0.004 |
| Pb | 0.001 | 0.001 | 0.004 | 0.005 | 0.004 | 0.003 | 0.002 | 0.004 | 0.004 | 0.002 | 0.002 | 0.004 | 0.003 | 0.002 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.010 | 0.005 | 0.008 | 0.000 | 0.000 | 0.012 | 0.007 | 0.001 | 0.003 | 0.002 | 0.000 | 0.003 | 0.000 | 0.002 | 0.000 |
| Ca | 0.000 | 0.005 | 0.001 | 0.000 | 0.000 | 0.172 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.003 |
| Total | 2.995 | 2.991 | 2.999 | 2.994 | 2.996 | 3.014 | 2.994 | 2.991 | 2.987 | 2.991 | 2.992 | 2.990 | 2.995 | 2.990 | 2.968 |
| Mn/(Mn+Fe) | 0.570 | 0.574 | 0.582 | 0.564 | 0.571 | 0.373 | 0.343 | 0.370 | 0.360 | 0.378 | 0.376 | 0.365 | 0.384 | 0.378 | 0.446 |
| Ta/(Ta+Nb) | 0.713 | 0.731 | 0.260 | 0.247 | 0.246 | 0.550 | 0.574 | 0.324 | 0.287 | 0.438 | 0.574 | 0.307 | 0.372 | 0.532 | 0.644 |
| Comments: | AD - AF | | | unzoned | | | | DE & DF same grain | | DH - DL spectacular cluster of 3 zoned grains | | | | | |
| | same grain | | | | | | | patchy zoned | | primary | | | primary | | |
| | core | mid | rim | | | | | primary | | | | | | | |

**Big Whopper pegmatite**

97-186C

| | CA | CB | CC | CD | CE | CF | CG | CH | CN | CP |
|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 9.53 | 8.44 | 10.26 | 9.51 | 9.82 | 10.23 | 10.14 | 6.67 | 10.09 | 8.95 |
| MnO | 8.36 | 7.92 | 8.56 | 8.38 | 8.41 | 8.68 | 8.52 | 10.92 | 8.44 | 7.60 |
| TiO2 | 0.50 | 0.18 | 0.51 | 0.24 | 0.60 | 0.58 | 0.51 | 0.34 | 0.56 | 0.28 |
| Nb2O5 | 52.71 | 34.21 | 61.46 | 51.86 | 55.36 | 60.47 | 57.52 | 48.79 | 62.34 | 38.11 |
| Ta2O5 | 27.14 | 48.22 | 17.26 | 28.71 | 24.69 | 19.31 | 21.71 | 31.40 | 17.42 | 43.80 |
| SnO2 | 0.16 | 0.02 | 0.10 | 0.07 | 0.18 | 0.14 | 0.10 | 0.10 | 0.14 | 0.11 |
| WO3 | 0.64 | 0.46 | 0.30 | 0.53 | 0.35 | 0.43 | 0.31 | 0.72 | 0.51 | 0.37 |
| PbO | 0.25 | 0.20 | 0.28 | 0.29 | 0.23 | 0.30 | 0.23 | 0.23 | 0.32 | 0.17 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.04 | 0.00 | 0.05 | 0.06 | 0.09 | 0.07 | 0.04 | 0.07 | 0.00 |
| CaO | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 |
| Total | 99.30 | 99.70 | 98.72 | 99.64 | 99.68 | 100.22 | 99.12 | 99.22 | 99.90 | 99.40 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.506 | 0.492 | 0.524 | 0.507 | 0.512 | 0.519 | 0.526 | 0.361 | 0.509 | 0.512 |
| Mn | 0.449 | 0.468 | 0.443 | 0.452 | 0.445 | 0.446 | 0.448 | 0.599 | 0.431 | 0.441 |
| Ti | 0.024 | 0.009 | 0.023 | 0.012 | 0.028 | 0.027 | 0.024 | 0.017 | 0.026 | 0.015 |
| Nb | 1.512 | 1.079 | 1.698 | 1.494 | 1.562 | 1.659 | 1.613 | 1.429 | 1.701 | 1.180 |
| Ta | 0.468 | 0.915 | 0.287 | 0.497 | 0.419 | 0.319 | 0.366 | 0.553 | 0.286 | 0.816 |
| Sn | 0.004 | 0.001 | 0.003 | 0.002 | 0.005 | 0.003 | 0.002 | 0.003 | 0.003 | 0.003 |
| W | 0.011 | 0.008 | 0.005 | 0.009 | 0.006 | 0.007 | 0.005 | 0.012 | 0.008 | 0.007 |
| Pb | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.002 | 0.000 | 0.003 | 0.003 | 0.005 | 0.004 | 0.002 | 0.004 | 0.000 |
| Ca | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.980 | 2.980 | 2.988 | 2.981 | 2.983 | 2.988 | 2.992 | 2.981 | 2.973 | 2.976 |
| Mn/(Mn+Fe) | 0.470 | 0.487 | 0.458 | 0.471 | 0.465 | 0.462 | 0.460 | 0.624 | 0.459 | 0.463 |
| Ta/(Ta+Nb) | 0.236 | 0.459 | 0.145 | 0.250 | 0.212 | 0.161 | 0.185 | 0.279 | 0.144 | 0.409 |
| Comments: | | CA - CD<br>same grain<br>patchy zoned | | | | CE - CG<br>same grain<br>patchy zoned | | | | |

| | Big Whopper pegmatite | | | | | | Big Whopper peg. | | |
|---|---|---|---|---|---|---|---|---|---|
| | 97-186X | | | | | | 97-186Z | | |
| | GL | GQ | GR1 | GR2 | GR3 | GR4 | CI | CJ | CK |
| FeO | 5.99 | 6.16 | 5.99 | 4.70 | 5.05 | 5.65 | 6.18 | 6.29 | 5.97 |
| MnO | 11.12 | 10.77 | 11.05 | 12.21 | 11.88 | 11.50 | 11.52 | 10.11 | 9.51 |
| TiO2 | 0.28 | 0.35 | 0.24 | 0.32 | 0.39 | 0.37 | 0.98 | 0.04 | 0.11 |
| Nb2O5 | 44.66 | 46.02 | 46.23 | 44.87 | 45.47 | 45.42 | 48.82 | 31.56 | 21.37 |
| Ta2O5 | 36.31 | 35.10 | 35.25 | 36.13 | 35.49 | 35.12 | 25.85 | 51.26 | 62.04 |
| SnO2 | 0.10 | 0.04 | 0.09 | 0.08 | 0.12 | 0.09 | 0.32 | 0.05 | 0.19 |
| WO3 | 0.72 | 0.60 | 0.51 | 0.92 | 0.97 | 0.88 | 0.85 | 0.19 | 0.20 |
| PbO | 0.17 | 0.22 | 0.22 | 0.17 | 0.19 | 0.25 | 0.37 | 0.14 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.14 | 0.07 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 |
| CaO | 0.01 | 0.02 | 0.03 | 0.00 | 0.02 | 0.02 | 0.19 | 0.00 | 0.00 |
| Total | 99.34 | 99.40 | 99.67 | 99.41 | 99.57 | 99.43 | 95.25 | 99.64 | 99.43 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | |
| Fe | 0.331 | 0.338 | 0.328 | 0.260 | 0.277 | 0.311 | 0.343 | 0.373 | 0.375 |
| Mn | 0.623 | 0.599 | 0.613 | 0.683 | 0.661 | 0.641 | 0.647 | 0.607 | 0.605 |
| Ti | 0.014 | 0.017 | 0.012 | 0.016 | 0.019 | 0.018 | 0.049 | 0.002 | 0.006 |
| Nb | 1.336 | 1.365 | 1.369 | 1.339 | 1.351 | 1.350 | 1.464 | 1.012 | 0.726 |
| Ta | 0.653 | 0.627 | 0.628 | 0.649 | 0.634 | 0.628 | 0.466 | 0.988 | 1.268 |
| Sn | 0.003 | 0.001 | 0.002 | 0.002 | 0.003 | 0.002 | 0.008 | 0.001 | 0.006 |
| W | 0.012 | 0.010 | 0.009 | 0.016 | 0.016 | 0.015 | 0.015 | 0.004 | 0.004 |
| Pb | 0.003 | 0.004 | 0.004 | 0.003 | 0.003 | 0.004 | 0.007 | 0.003 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.008 | 0.004 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 |
| Ca | 0.001 | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.014 | 0.000 | 0.000 |
| Total | 2.976 | 2.970 | 2.971 | 2.968 | 2.967 | 2.978 | 3.015 | 2.990 | 2.990 |
| Mn/(Mn+Fe) | 0.653 | 0.639 | 0.652 | 0.725 | 0.705 | 0.673 | 0.654 | 0.619 | 0.617 |
| Ta/(Ta+Nb) | 0.328 | 0.315 | 0.314 | 0.326 | 0.320 | 0.317 | 0.242 | 0.494 | 0.636 |
| Comments: | | | | GR traverse 4 points<br>minimal zoning apart from patchy rim | | | | CJ & CK<br>same grain<br>cassiterite-rich sample | |

| | Big Whopper pegmatite | | | | | | | | | School of Fish pegmatite | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-198 | | | | | | | | | 97-264 | | | |
| | GA | GB | GD | GE | GH | GI | GJ | GK | GL | HK | HL | HM | HP |
| FeO | 1.30 | 1.50 | 1.66 | 1.53 | 1.59 | 1.75 | 1.33 | 1.38 | 1.68 | 9.96 | 10.09 | 9.75 | 10.80 |
| MnO | 14.73 | 14.85 | 16.25 | 13.91 | 16.33 | 16.19 | 14.07 | 14.22 | 16.33 | 4.98 | 5.16 | 5.36 | 4.17 |
| TiO2 | 0.17 | 0.05 | 0.12 | 0.00 | 0.29 | 0.25 | 0.09 | 0.10 | 0.20 | 0.00 | 0.04 | 0.05 | 0.77 |
| Nb2O5 | 29.56 | 33.18 | 49.84 | 22.41 | 47.44 | 48.80 | 20.42 | 24.02 | 48.51 | 17.36 | 19.88 | 17.30 | 19.33 |
| Ta2O5 | 52.50 | 49.75 | 31.89 | 61.05 | 31.52 | 31.66 | 61.56 | 57.67 | 32.00 | 66.69 | 63.60 | 66.50 | 63.07 |
| SnO2 | 0.31 | 0.13 | 0.04 | 0.08 | 0.08 | 0.02 | 0.41 | 0.39 | 0.07 | 0.08 | 0.03 | 0.17 | 0.45 |
| WO3 | 0.29 | 0.16 | 0.25 | 0.20 | 1.00 | 0.70 | 0.49 | 0.58 | 0.61 | 0.14 | 0.20 | 0.29 | 0.52 |
| PbO | 0.12 | 0.16 | 0.24 | 0.11 | 0.20 | 0.28 | 0.20 | 0.13 | 0.22 | 0.12 | 0.07 | 0.07 | 0.06 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | 0.05 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.09 | 0.04 |
| CaO | 0.02 | 0.01 | 0.03 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.03 | 0.01 | 0.03 |
| Total | 99.00 | 99.78 | 100.34 | 99.33 | 98.49 | 99.72 | 98.58 | 98.52 | 99.63 | 99.34 | 99.09 | 99.59 | 99.23 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.078 | 0.088 | 0.089 | 0.096 | 0.087 | 0.095 | 0.085 | 0.086 | 0.091 | 0.643 | 0.642 | 0.627 | 0.683 |
| Mn | 0.897 | 0.883 | 0.882 | 0.881 | 0.906 | 0.885 | 0.907 | 0.897 | 0.895 | 0.325 | 0.333 | 0.349 | 0.267 |
| Ti | 0.009 | 0.003 | 0.006 | 0.000 | 0.014 | 0.012 | 0.005 | 0.006 | 0.010 | 0.000 | 0.002 | 0.003 | 0.044 |
| Nb | 0.961 | 1.052 | 1.443 | 0.758 | 1.405 | 1.424 | 0.702 | 0.809 | 1.419 | 0.606 | 0.684 | 0.601 | 0.661 |
| Ta | 1.027 | 0.949 | 0.556 | 1.242 | 0.562 | 0.556 | 1.274 | 1.169 | 0.563 | 1.400 | 1.317 | 1.390 | 1.298 |
| Sn | 0.009 | 0.003 | 0.001 | 0.002 | 0.002 | 0.000 | 0.013 | 0.011 | 0.002 | 0.002 | 0.001 | 0.005 | 0.014 |
| W | 0.005 | 0.003 | 0.004 | 0.004 | 0.017 | 0.012 | 0.010 | 0.011 | 0.010 | 0.003 | 0.004 | 0.006 | 0.010 |
| Pb | 0.002 | 0.003 | 0.004 | 0.002 | 0.004 | 0.005 | 0.004 | 0.003 | 0.004 | 0.002 | 0.001 | 0.002 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.003 |
| Ca | 0.002 | 0.001 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.002 | 0.001 | 0.002 |
| Total | 2.990 | 2.985 | 2.987 | 2.989 | 2.999 | 2.992 | 2.999 | 2.994 | 2.995 | 2.983 | 2.987 | 2.990 | 2.983 |
| Mn/(Mn+Fe) | 0.920 | 0.909 | 0.908 | 0.902 | 0.912 | 0.903 | 0.914 | 0.912 | 0.908 | 0.336 | 0.341 | 0.358 | 0.281 |
| Ta/(Ta+Nb) | 0.517 | 0.474 | 0.278 | 0.621 | 0.286 | 0.281 | 0.645 | 0.591 | 0.284 | 0.698 | 0.658 | 0.698 | 0.663 |
| Comments: | GA & GB | | GD & GE | | GH & GI | | | GJ - GL | | | HK - HM | | earlier |
| | same grain | | same grain | | same grain | | same grain | | altered rim | | same grain | | than |
| | | | | | | | | | | | | | cassiterite |

| | Bob's pegmatite | | | | Bob's | Bob's | | Big Whopper pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BP1 | | | | 97-BP2 | 97-BP3 | | 97-BW1 | | | | |
| | BK | BL | BM | BN | AC | RB | QL | KA | KB | KC | KD | KE |
| FeO | 7.38 | 7.13 | 7.76 | 6.01 | 4.35 | 5.13 | 4.73 | 2.03 | 1.74 | 1.59 | 1.50 | 1.75 |
| MnO | 11.00 | 10.93 | 10.96 | 8.87 | 12.79 | 11.69 | 13.34 | 14.61 | 14.55 | 13.77 | 13.89 | 14.96 |
| TiO2 | 0.43 | 0.45 | 0.47 | 0.48 | 0.48 | 0.21 | 0.40 | 0.31 | 0.09 | 0.18 | 0.14 | 0.12 |
| Nb2O5 | 48.40 | 45.80 | 50.96 | 12.97 | 40.34 | 33.69 | 50.06 | 33.49 | 30.91 | 22.12 | 22.27 | 33.89 |
| Ta2O5 | 31.01 | 34.38 | 28.60 | 69.35 | 40.50 | 47.85 | 29.24 | 48.33 | 51.17 | 61.19 | 60.15 | 47.44 |
| SnO2 | 0.13 | 0.19 | 0.12 | 0.26 | 0.15 | 0.13 | 0.16 | 0.09 | 0.04 | 0.21 | 1.00 | 0.04 |
| WO3 | 0.40 | 0.46 | 0.39 | 0.33 | 0.57 | 0.49 | 0.34 | 0.56 | 0.29 | 0.36 | 0.35 | 0.38 |
| PbO | 0.22 | 0.27 | 0.25 | 0.00 | 0.32 | 0.19 | 0.20 | 0.16 | 0.16 | 0.09 | 0.14 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.03 | 0.18 | 0.00 | 0.03 | 0.06 | 0.03 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.01 | 0.00 | 0.00 | 0.01 | 0.01 | 0.02 | 0.01 |
| Total | 98.98 | 99.65 | 99.72 | 98.28 | 99.68 | 99.44 | 98.49 | 99.61 | 98.96 | 99.51 | 99.49 | 98.74 |
| | | | | | | | | | | | | |
| | Structural formulae based on 6 oxygens | | | | | | | | | | | |
| Fe | 0.401 | 0.390 | 0.413 | 0.399 | 0.245 | 0.300 | 0.256 | 0.119 | 0.104 | 0.100 | 0.093 | 0.103 |
| Mn | 0.605 | 0.606 | 0.591 | 0.597 | 0.729 | 0.693 | 0.731 | 0.865 | 0.881 | 0.871 | 0.877 | 0.891 |
| Ti | 0.021 | 0.022 | 0.022 | 0.029 | 0.024 | 0.011 | 0.019 | 0.016 | 0.005 | 0.010 | 0.008 | 0.006 |
| Nb | 1.421 | 1.355 | 1.467 | 0.466 | 1.227 | 1.066 | 1.463 | 1.058 | 0.999 | 0.747 | 0.751 | 1.078 |
| Ta | 0.548 | 0.612 | 0.495 | 1.498 | 0.741 | 0.911 | 0.514 | 0.919 | 0.995 | 1.243 | 1.220 | 0.908 |
| Sn | 0.003 | 0.005 | 0.003 | 0.008 | 0.004 | 0.004 | 0.004 | 0.003 | 0.001 | 0.006 | 0.030 | 0.001 |
| W | 0.007 | 0.008 | 0.006 | 0.007 | 0.010 | 0.009 | 0.006 | 0.010 | 0.005 | 0.007 | 0.007 | 0.007 |
| Pb | 0.004 | 0.005 | 0.004 | 0.000 | 0.006 | 0.004 | 0.003 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.002 | 0.010 | 0.000 | 0.002 | 0.004 | 0.002 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 |
| Total | 3.009 | 3.005 | 3.013 | 3.004 | 2.999 | 3.001 | 2.998 | 2.995 | 2.993 | 2.986 | 2.992 | 2.999 |
| | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.602 | 0.608 | 0.589 | 0.599 | 0.749 | 0.698 | 0.741 | 0.879 | 0.894 | 0.897 | 0.904 | 0.896 |
| Ta/(Ta+Nb) | 0.278 | 0.311 | 0.252 | 0.763 | 0.377 | 0.461 | 0.260 | 0.465 | 0.499 | 0.625 | 0.619 | 0.457 |
| | | | | | | | | | | | | |
| Comments: | BK - BM<br>same grain | | | | | | | | | KC & KD<br>same grain | | |

| | Big Whopper pegmatite | | | | | Big Whopper pegmatite | | | | Big Whopper pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BW2 | | | | | 97-BW3 | | | | 97-BW4 | | | | |
| | RA | RB | RC | RD | RE | BG | BH | BI | BJ | AC | AD | AG | AH | AJ |
| FeO | 6.89 | 4.82 | 3.87 | 4.79 | 2.72 | 0.16 | 0.28 | 0.20 | 0.24 | 7.72 | 6.38 | 7.76 | 7.43 | 7.83 |
| MnO | 12.24 | 14.32 | 14.00 | 13.96 | 12.65 | 15.86 | 14.69 | 15.11 | 15.78 | 11.77 | 9.41 | 10.47 | 10.57 | 11.22 |
| TiO2 | 0.22 | 0.25 | 0.16 | 0.28 | 0.21 | 0.31 | 0.09 | 0.05 | 0.03 | 0.43 | 0.42 | 0.90 | 0.26 | 0.29 |
| Nb2O5 | 57.81 | 59.75 | 48.97 | 57.55 | 20.83 | 30.19 | 19.34 | 20.40 | 28.81 | 64.84 | 26.88 | 50.24 | 45.77 | 59.58 |
| Ta2O5 | 20.69 | 18.72 | 30.47 | 21.26 | 61.33 | 52.11 | 62.37 | 62.46 | 53.72 | 14.01 | 57.24 | 28.90 | 34.94 | 20.17 |
| SnO2 | 0.11 | 0.05 | 0.06 | 0.09 | 0.04 | 0.32 | 0.91 | 0.23 | 0.02 | 0.11 | 0.95 | 0.32 | 0.03 | 0.02 |
| WO3 | 0.57 | 0.36 | 0.38 | 0.46 | 0.41 | 0.79 | 0.44 | 0.31 | 0.21 | 0.24 | 0.17 | 0.51 | 0.34 | 0.33 |
| PbO | 0.26 | 0.32 | 0.21 | 0.26 | 0.06 | 0.15 | 0.13 | 0.07 | 0.04 | 0.34 | 0.18 | 0.30 | 0.17 | 0.29 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.05 |
| CaO | 0.00 | 0.00 | 0.01 | 0.02 | 0.03 | 0.02 | 0.05 | 0.03 | 0.04 | 0.01 | 0.02 | 0.01 | 0.01 | 0.01 |
| Total | 98.84 | 98.58 | 98.13 | 98.67 | 98.29 | 99.91 | 98.34 | 98.85 | 98.88 | 99.46 | 101.67 | 99.40 | 99.51 | 99.79 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.358 | 0.249 | 0.211 | 0.250 | 0.173 | 0.009 | 0.018 | 0.013 | 0.015 | 0.386 | 0.380 | 0.415 | 0.408 | 0.401 |
| Mn | 0.644 | 0.749 | 0.775 | 0.737 | 0.814 | 0.954 | 0.954 | 0.972 | 0.967 | 0.596 | 0.568 | 0.567 | 0.588 | 0.582 |
| Ti | 0.010 | 0.011 | 0.008 | 0.013 | 0.012 | 0.017 | 0.005 | 0.003 | 0.002 | 0.019 | 0.022 | 0.043 | 0.013 | 0.013 |
| Nb | 1.625 | 1.667 | 1.447 | 1.622 | 0.716 | 0.969 | 0.671 | 0.700 | 0.942 | 1.754 | 0.866 | 1.451 | 1.359 | 1.650 |
| Ta | 0.350 | 0.314 | 0.542 | 0.360 | 1.268 | 1.006 | 1.300 | 1.290 | 1.057 | 0.228 | 1.109 | 0.502 | 0.624 | 0.336 |
| Sn | 0.003 | 0.001 | 0.002 | 0.002 | 0.001 | 0.009 | 0.028 | 0.007 | 0.000 | 0.003 | 0.027 | 0.008 | 0.001 | 0.001 |
| W | 0.009 | 0.006 | 0.006 | 0.007 | 0.008 | 0.015 | 0.009 | 0.006 | 0.004 | 0.004 | 0.003 | 0.008 | 0.006 | 0.005 |
| Pb | 0.004 | 0.005 | 0.004 | 0.004 | 0.001 | 0.003 | 0.003 | 0.001 | 0.001 | 0.005 | 0.004 | 0.005 | 0.003 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.003 |
| Ca | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 | 0.004 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 |
| Total | 3.006 | 3.003 | 2.995 | 2.997 | 2.995 | 2.983 | 2.993 | 2.993 | 2.991 | 2.997 | 2.981 | 3.001 | 3.001 | 2.996 |
| Mn/(Mn+Fe) | 0.643 | 0.751 | 0.786 | 0.747 | 0.825 | 0.990 | 0.981 | 0.987 | 0.985 | 0.607 | 0.599 | 0.577 | 0.591 | 0.592 |
| Ta/(Ta+Nb) | 0.177 | 0.159 | 0.272 | 0.182 | 0.639 | 0.509 | 0.660 | 0.648 | 0.529 | 0.115 | 0.562 | 0.257 | 0.315 | 0.169 |
| Comments: | | incl. in quartz | | | | | BG - BI same grain patchy zoned | | | AC & AD same grain | | AG, AH & AJ same grain | | |
| | | | | | | | | | | | | core | inter | rim |

| | **Big Whopper pegmatite** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BW4 | | | | | | | | | | | | | | |
| | LE | RB | RC | RD | RE | RF | RJ1 | RJ2 | RJ3 | RJ4 | RJ5 | RJ6 | RJ7 | RK | RL |
| FeO | 8.18 | 8.26 | 8.30 | 8.04 | 7.54 | 7.04 | 7.25 | 6.32 | 2.99 | 4.88 | 6.31 | 6.77 | 7.55 | 6.25 | 6.61 |
| MnO | 11.14 | 11.05 | 10.71 | 10.60 | 10.15 | 8.93 | 10.78 | 9.69 | 14.02 | 12.12 | 9.58 | 10.12 | 11.07 | 9.15 | 9.76 |
| TiO2 | 1.35 | 1.29 | 1.71 | 1.00 | 1.44 | 2.49 | 0.20 | 0.00 | 0.45 | 0.46 | 0.02 | 0.04 | 0.18 | 0.08 | 0.03 |
| Nb2O5 | 60.33 | 61.02 | 58.54 | 55.30 | 45.00 | 28.79 | 47.60 | 26.08 | 38.15 | 38.82 | 25.62 | 35.94 | 55.07 | 19.31 | 29.97 |
| Ta2O5 | 15.67 | 16.05 | 17.58 | 22.52 | 32.98 | 48.85 | 32.41 | 56.77 | 42.07 | 41.62 | 57.37 | 46.14 | 24.22 | 64.65 | 52.43 |
| SnO2 | 0.41 | 0.38 | 0.49 | 0.31 | 0.41 | 0.89 | 0.03 | 0.06 | 0.26 | 0.33 | 0.05 | 0.00 | 0.00 | 0.07 | 0.12 |
| WO3 | 0.61 | 0.64 | 0.60 | 0.54 | 0.88 | 1.76 | 0.38 | 0.12 | 1.01 | 0.34 | 0.15 | 0.17 | 0.37 | 0.20 | 0.20 |
| PbO | 0.39 | 0.36 | 0.34 | 0.29 | 0.25 | 0.12 | 0.26 | 0.13 | 0.18 | 0.33 | 0.11 | 0.15 | 0.33 | 0.11 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | 0.12 | 0.00 | 0.06 | 0.00 | 0.14 | 0.01 | 0.14 | 0.11 | 0.11 | 0.02 | 0.01 | 0.05 | 0.00 | 0.05 | 0.04 |
| CaO | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.02 | 0.06 | 0.02 | 0.04 | 0.02 | 0.04 | 0.00 | 0.00 |
| Total | 98.19 | 99.05 | 98.35 | 98.61 | 98.78 | 98.94 | 99.06 | 99.31 | 99.30 | 99.04 | 99.28 | 99.40 | 98.83 | 99.88 | 99.31 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.418 | 0.418 | 0.426 | 0.421 | 0.413 | 0.415 | 0.396 | 0.387 | 0.170 | 0.279 | 0.388 | 0.393 | 0.398 | 0.396 | 0.396 |
| Mn | 0.577 | 0.567 | 0.557 | 0.563 | 0.563 | 0.533 | 0.596 | 0.601 | 0.810 | 0.701 | 0.596 | 0.594 | 0.591 | 0.588 | 0.592 |
| Ti | 0.062 | 0.059 | 0.079 | 0.047 | 0.071 | 0.132 | 0.010 | 0.000 | 0.023 | 0.024 | 0.001 | 0.002 | 0.009 | 0.004 | 0.002 |
| Nb | 1.666 | 1.672 | 1.625 | 1.566 | 1.332 | 0.918 | 1.405 | 0.864 | 1.176 | 1.198 | 0.851 | 1.126 | 1.571 | 0.661 | 0.971 |
| Ta | 0.260 | 0.265 | 0.293 | 0.384 | 0.588 | 0.937 | 0.575 | 1.131 | 0.780 | 0.772 | 1.147 | 0.870 | 0.416 | 1.332 | 1.022 |
| Sn | 0.010 | 0.009 | 0.012 | 0.008 | 0.011 | 0.025 | 0.001 | 0.002 | 0.007 | 0.009 | 0.001 | 0.000 | 0.000 | 0.002 | 0.004 |
| W | 0.010 | 0.010 | 0.010 | 0.009 | 0.015 | 0.032 | 0.006 | 0.002 | 0.018 | 0.006 | 0.003 | 0.003 | 0.006 | 0.004 | 0.004 |
| Pb | 0.006 | 0.006 | 0.006 | 0.005 | 0.004 | 0.002 | 0.005 | 0.003 | 0.003 | 0.006 | 0.002 | 0.003 | 0.006 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.007 | 0.000 | 0.003 | 0.000 | 0.008 | 0.001 | 0.008 | 0.007 | 0.006 | 0.001 | 0.000 | 0.003 | 0.000 | 0.003 | 0.003 |
| Ca | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.001 | 0.001 | 0.004 | 0.002 | 0.003 | 0.001 | 0.003 | 0.000 | 0.000 |
| Total | 3.015 | 3.007 | 3.011 | 3.002 | 3.005 | 2.997 | 3.002 | 2.998 | 2.998 | 2.998 | 2.994 | 2.996 | 2.999 | 2.994 | 2.996 |
| Mn/(Mn+Fe) | 0.580 | 0.575 | 0.567 | 0.572 | 0.577 | 0.562 | 0.601 | 0.608 | 0.826 | 0.715 | 0.606 | 0.602 | 0.597 | 0.597 | 0.599 |
| Ta/(Ta+Nb) | 0.135 | 0.137 | 0.153 | 0.197 | 0.306 | 0.505 | 0.291 | 0.567 | 0.399 | 0.392 | 0.574 | 0.436 | 0.209 | 0.668 | 0.513 |

Comments: RB - RF same grain

RG - RI high Ti, Sn & W rim - see ixiolite

RJ traverse along patchy zoned grain

RK & RL same grain as RJ

| | **Big Whopper pegmatite** | | | | **Big Whopper pegmatite** | | | | | | **Big Whopper peg.** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BW5 | | | | 97-BW7A | | | | | | 97-BW7B | | |
| | HH | HT | HY | HZ | GC | GH | GI | GK | GL | GP | JL | JM | JN |
| FeO | 16.04 | 16.67 | 14.12 | 14.36 | 10.46 | 8.56 | 9.05 | 7.88 | 8.34 | 8.16 | 12.30 | 12.38 | 12.05 |
| MnO | 2.50 | 2.24 | 2.00 | 2.10 | 4.94 | 6.54 | 6.39 | 7.05 | 7.07 | 7.36 | 3.91 | 3.63 | 3.88 |
| TiO2 | 0.76 | 0.53 | 0.51 | 0.57 | 0.10 | 0.28 | 0.29 | 0.06 | 0.04 | 0.29 | 0.67 | 0.68 | 0.57 |
| Nb2O5 | 50.96 | 60.03 | 31.02 | 31.50 | 20.30 | 12.90 | 16.76 | 13.39 | 17.48 | 20.86 | 25.73 | 25.74 | 26.45 |
| Ta2O5 | 28.88 | 17.17 | 51.11 | 50.84 | 62.87 | 70.72 | 66.46 | 71.47 | 67.31 | 62.26 | 56.84 | 54.89 | 54.53 |
| SnO2 | 0.13 | 0.08 | 0.50 | 0.28 | 0.40 | 0.18 | 0.14 | 0.06 | 0.04 | 0.13 | 0.32 | 1.86 | 1.52 |
| WO3 | 0.71 | 0.77 | 0.45 | 0.68 | 0.21 | 0.26 | 0.30 | 0.23 | 0.24 | 0.28 | 0.14 | 0.17 | 0.12 |
| PbO | 0.20 | 0.27 | 0.09 | 0.16 | 0.06 | 0.01 | 0.11 | 0.09 | 0.09 | 0.02 | 0.08 | 0.07 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.01 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.04 | 0.00 | 0.00 | 0.06 | 0.03 | 0.04 | 0.07 | 0.00 | 0.06 | 0.01 | 0.15 | 0.00 | 0.02 |
| CaO | 0.01 | 0.03 | 0.00 | 0.01 | 0.03 | 0.01 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.04 |
| Total | 100.25 | 97.79 | 99.80 | 100.55 | 99.38 | 99.58 | 99.60 | 100.26 | 100.72 | 99.36 | 100.13 | 99.43 | 99.28 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.850 | 0.863 | 0.835 | 0.841 | 0.662 | 0.564 | 0.582 | 0.516 | 0.530 | 0.514 | 0.744 | 0.753 | 0.732 |
| Mn | 0.134 | 0.118 | 0.120 | 0.124 | 0.316 | 0.436 | 0.416 | 0.468 | 0.455 | 0.469 | 0.240 | 0.224 | 0.239 |
| Ti | 0.036 | 0.025 | 0.027 | 0.030 | 0.006 | 0.016 | 0.017 | 0.003 | 0.002 | 0.016 | 0.036 | 0.037 | 0.031 |
| Nb | 1.460 | 1.680 | 0.992 | 0.997 | 0.694 | 0.459 | 0.583 | 0.474 | 0.601 | 0.710 | 0.842 | 0.846 | 0.869 |
| Ta | 0.498 | 0.289 | 0.983 | 0.968 | 1.293 | 1.514 | 1.390 | 1.521 | 1.392 | 1.274 | 1.119 | 1.085 | 1.077 |
| Sn | 0.003 | 0.002 | 0.014 | 0.008 | 0.012 | 0.006 | 0.004 | 0.002 | 0.001 | 0.004 | 0.009 | 0.054 | 0.044 |
| W | 0.012 | 0.012 | 0.008 | 0.012 | 0.004 | 0.005 | 0.006 | 0.005 | 0.005 | 0.005 | 0.003 | 0.003 | 0.002 |
| Pb | 0.003 | 0.004 | 0.002 | 0.003 | 0.001 | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 | 0.002 | 0.001 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.000 | 0.000 | 0.004 | 0.002 | 0.003 | 0.005 | 0.000 | 0.004 | 0.000 | 0.009 | 0.000 | 0.001 |
| Ca | 0.000 | 0.002 | 0.000 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 |
| Total | 2.999 | 2.995 | 2.980 | 2.988 | 2.992 | 3.005 | 3.006 | 2.992 | 2.994 | 2.993 | 3.004 | 3.005 | 3.000 |
| Mn/(Mn+Fe) | 0.136 | 0.120 | 0.125 | 0.129 | 0.323 | 0.436 | 0.417 | 0.476 | 0.462 | 0.477 | 0.243 | 0.229 | 0.246 |
| Ta/(Ta+Nb) | 0.254 | 0.147 | 0.498 | 0.493 | 0.651 | 0.767 | 0.705 | 0.762 | 0.698 | 0.642 | 0.571 | 0.562 | 0.554 |
| Comments: | | | HT & HY<br>same grain<br>incl. in cass. | | | GH & GI<br>same grain<br>petalite part | | GK & GL<br>same grain<br>petalite part | | | incl.<br>in cass. | JM & JN<br>same grain<br>incl. in cass. | |

**Big Whopper pegmatite**

97-BW7B

| | JO1 | JO2 | JO3 | JO4 | JO5 | JO6 | JO7 | JO8 | JO9 | JO10 | JP | JQ | JR | JS | JT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.78 | 10.60 | 10.87 | 11.01 | 10.90 | 10.51 | 10.53 | 10.62 | 11.02 | 10.63 | 10.69 | 9.94 | 10.68 | 10.22 | 10.83 |
| MnO | 7.58 | 7.41 | 7.49 | 7.60 | 7.50 | 7.41 | 7.44 | 7.40 | 7.56 | 7.61 | 7.75 | 7.82 | 7.75 | 6.66 | 7.36 |
| TiO2 | 0.50 | 0.32 | 0.44 | 0.55 | 0.54 | 0.28 | 0.25 | 0.37 | 0.43 | 0.40 | 0.31 | 0.30 | 0.53 | 0.77 | 0.60 |
| Nb2O5 | 50.55 | 46.95 | 51.04 | 51.91 | 51.13 | 45.94 | 46.98 | 47.77 | 52.55 | 50.22 | 50.63 | 49.47 | 53.00 | 39.34 | 51.51 |
| Ta2O5 | 29.74 | 33.90 | 29.38 | 28.01 | 28.77 | 34.65 | 34.01 | 31.45 | 27.60 | 29.58 | 29.58 | 31.00 | 25.70 | 40.47 | 27.96 |
| SnO2 | 0.11 | 0.11 | 0.12 | 0.10 | 0.13 | 0.03 | 0.11 | 0.11 | 0.11 | 0.10 | 0.07 | 0.06 | 0.11 | 0.25 | 0.18 |
| WO3 | 0.52 | 0.40 | 0.48 | 0.52 | 0.57 | 0.52 | 0.51 | 0.53 | 0.51 | 0.53 | 0.63 | 0.46 | 1.24 | 0.56 | 0.54 |
| PbO | 0.24 | 0.20 | 0.19 | 0.26 | 0.22 | 0.26 | 0.23 | 0.22 | 0.21 | 0.28 | 0.21 | 0.24 | 0.30 | 0.23 | 0.29 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.13 | 0.06 | 0.04 | 0.35 | 0.03 | 0.06 | 0.03 |
| CaO | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.01 | 0.04 | 0.00 | 0.00 | 0.01 | 0.11 | 0.01 | 0.00 | 0.01 |
| Total | 100.03 | 99.91 | 100.02 | 99.97 | 99.77 | 99.62 | 100.09 | 98.52 | 100.12 | 99.42 | 99.91 | 99.83 | 99.34 | 98.55 | 99.30 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.575 | 0.577 | 0.579 | 0.583 | 0.580 | 0.577 | 0.573 | 0.581 | 0.581 | 0.571 | 0.571 | 0.534 | 0.565 | 0.582 | 0.577 |
| Mn | 0.409 | 0.409 | 0.404 | 0.407 | 0.405 | 0.412 | 0.409 | 0.410 | 0.404 | 0.414 | 0.419 | 0.425 | 0.415 | 0.384 | 0.398 |
| Ti | 0.024 | 0.016 | 0.021 | 0.026 | 0.026 | 0.014 | 0.012 | 0.018 | 0.021 | 0.019 | 0.015 | 0.014 | 0.025 | 0.039 | 0.029 |
| Nb | 1.457 | 1.381 | 1.468 | 1.486 | 1.472 | 1.362 | 1.381 | 1.413 | 1.498 | 1.458 | 1.462 | 1.436 | 1.516 | 1.211 | 1.485 |
| Ta | 0.516 | 0.600 | 0.508 | 0.482 | 0.498 | 0.618 | 0.601 | 0.560 | 0.473 | 0.517 | 0.514 | 0.541 | 0.442 | 0.750 | 0.485 |
| Sn | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.001 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.007 | 0.005 |
| W | 0.009 | 0.007 | 0.008 | 0.009 | 0.009 | 0.009 | 0.009 | 0.009 | 0.008 | 0.009 | 0.010 | 0.008 | 0.020 | 0.010 | 0.009 |
| Pb | 0.004 | 0.004 | 0.003 | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 | 0.005 | 0.004 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.007 | 0.003 | 0.002 | 0.020 | 0.002 | 0.004 | 0.002 |
| Ca | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.007 | 0.000 | 0.000 | 0.000 |
| Total | 2.997 | 2.996 | 2.995 | 3.001 | 2.997 | 2.998 | 2.994 | 3.001 | 2.999 | 2.998 | 2.999 | 2.992 | 2.993 | 2.991 | 2.994 |
| Mn/(Mn+Fe) | 0.416 | 0.415 | 0.411 | 0.411 | 0.411 | 0.417 | 0.417 | 0.414 | 0.410 | 0.420 | 0.423 | 0.443 | 0.424 | 0.397 | 0.408 |
| Ta/(Ta+Nb) | 0.261 | 0.303 | 0.257 | 0.245 | 0.253 | 0.312 | 0.303 | 0.284 | 0.240 | 0.262 | 0.260 | 0.274 | 0.226 | 0.382 | 0.246 |
| Comments: | | | | | | JO - traverse across 200 µm grain<br>patchy zonation | | | | | JP & JQ<br>same grain | | | JS & JT<br>same grain<br>rim | core |

| | Big Whopper pegmatite | | | | | | | | | Great White North pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BW8 | | | | | | | | | 97-GWN1 | | | | | |
| | FC | FD | FE | FF | FG | FK | FL | FM | FN | BA | BB | BC | BD | BE | BF |
| FeO | 6.43 | 7.30 | 7.13 | 7.03 | 6.31 | 6.84 | 6.01 | 7.12 | 6.17 | 14.82 | 14.26 | 14.59 | 14.44 | 14.69 | 12.57 |
| MnO | 8.32 | 10.31 | 9.52 | 9.10 | 9.20 | 9.30 | 7.88 | 11.46 | 12.17 | 5.31 | 5.08 | 5.63 | 5.24 | 5.23 | 4.45 |
| TiO2 | 0.00 | 0.35 | 0.06 | 0.00 | 0.03 | 0.00 | 0.00 | 0.38 | 0.30 | 0.34 | 0.31 | 0.38 | 0.27 | 0.37 | 0.22 |
| Nb2O5 | 11.52 | 50.06 | 34.74 | 24.91 | 20.43 | 25.48 | 9.35 | 50.42 | 49.03 | 65.75 | 56.70 | 65.44 | 60.49 | 64.37 | 33.40 |
| Ta2O5 | 72.36 | 27.76 | 52.10 | 58.44 | 63.58 | 58.84 | 72.16 | 29.78 | 31.01 | 12.33 | 22.74 | 13.10 | 17.15 | 14.34 | 47.83 |
| SnO2 | 0.60 | 0.05 | 0.09 | 0.24 | 0.12 | 0.11 | 0.63 | 0.13 | 0.08 | 0.08 | 0.04 | 0.06 | 0.08 | 0.09 | 0.10 |
| WO3 | 0.18 | 0.58 | 0.17 | 0.18 | 0.28 | 0.18 | 0.21 | 0.58 | 0.85 | 0.35 | 0.54 | 0.37 | 0.31 | 0.44 | 0.53 |
| PbO | 0.07 | 0.20 | 0.15 | 0.16 | 0.08 | 0.10 | 0.04 | 0.28 | 0.17 | 0.33 | 0.26 | 0.29 | 0.29 | 0.33 | 0.09 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.02 | 0.10 | 0.02 | 0.00 | 0.09 | 0.00 | 0.00 | 0.08 | 0.00 | 0.11 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 |
| CaO | 0.03 | 0.00 | 0.02 | 0.02 | 0.01 | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 |
| Total | 99.55 | 96.69 | 104.00 | 100.08 | 100.13 | 100.86 | 96.28 | 100.26 | 99.78 | 99.42 | 99.94 | 99.90 | 98.26 | 99.87 | 99.20 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.428 | 0.400 | 0.402 | 0.431 | 0.396 | 0.415 | 0.419 | 0.379 | 0.332 | 0.739 | 0.739 | 0.726 | 0.745 | 0.735 | 0.739 |
| Mn | 0.561 | 0.573 | 0.543 | 0.565 | 0.585 | 0.572 | 0.556 | 0.618 | 0.663 | 0.268 | 0.267 | 0.284 | 0.273 | 0.265 | 0.265 |
| Ti | 0.000 | 0.017 | 0.003 | 0.000 | 0.002 | 0.000 | 0.000 | 0.018 | 0.014 | 0.015 | 0.015 | 0.017 | 0.012 | 0.017 | 0.011 |
| Nb | 0.415 | 1.485 | 1.058 | 0.825 | 0.694 | 0.836 | 0.352 | 1.452 | 1.427 | 1.772 | 1.589 | 1.760 | 1.686 | 1.741 | 1.061 |
| Ta | 1.567 | 0.495 | 0.954 | 1.165 | 1.298 | 1.161 | 1.635 | 0.516 | 0.543 | 0.200 | 0.383 | 0.212 | 0.287 | 0.233 | 0.914 |
| Sn | 0.019 | 0.001 | 0.002 | 0.007 | 0.004 | 0.003 | 0.021 | 0.003 | 0.002 | 0.002 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 |
| W | 0.004 | 0.010 | 0.003 | 0.003 | 0.005 | 0.003 | 0.004 | 0.010 | 0.014 | 0.005 | 0.009 | 0.006 | 0.005 | 0.007 | 0.010 |
| Pb | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.001 | 0.005 | 0.003 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.001 | 0.005 | 0.001 | 0.000 | 0.006 | 0.000 | 0.000 | 0.004 | 0.000 | 0.006 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Ca | 0.003 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| Total | 3.000 | 2.990 | 2.970 | 3.001 | 2.992 | 2.994 | 2.989 | 3.006 | 3.000 | 3.012 | 3.008 | 3.012 | 3.016 | 3.006 | 3.005 |
| Mn/(Mn+Fe) | 0.567 | 0.589 | 0.575 | 0.567 | 0.596 | 0.579 | 0.571 | 0.620 | 0.666 | 0.266 | 0.265 | 0.281 | 0.269 | 0.265 | 0.264 |
| Ta/(Ta+Nb) | 0.791 | 0.250 | 0.474 | 0.585 | 0.652 | 0.581 | 0.823 | 0.262 | 0.276 | 0.101 | 0.194 | 0.107 | 0.146 | 0.118 | 0 463 |
| Comments: | FC & FD | | FE - FG | | | | | | | | BA - BC | | BD - BF | | |
| | same grain | | same grain | core | | | | | | | same grain | | same grain | | core |
| | FD FM & FN are all near a veinlet - may explain different Ta content (but so is FC ?) | | | | | | | | | | patchy zonation | | | patchy zonation | |

| | Great White North peg. | | | | | Great White North pegmatite | | | | Great White North pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-GWN1 | | | | | 97-GWN2 | | | | 97-GWN3 | | | | |
| | BG | BH | TB | TC | TD | HL | HN | HO | HP | FB | FC | FD | FE | FF |
| FeO | 14.70 | 14.23 | 14.27 | 13.58 | 13.61 | 5.45 | 6.32 | 6.15 | 6.42 | 13.10 | 13.00 | 12.80 | 13.31 | 12.92 |
| MnO | 5.24 | 5.22 | 4.84 | 5.00 | 5.29 | 9.43 | 9.49 | 10.53 | 9.30 | 6.29 | 6.47 | 6.20 | 6.41 | 6.00 |
| TiO2 | 0.29 | 0.24 | 0.40 | 0.29 | 0.26 | 0.31 | 0.14 | 0.47 | 0.46 | 0.72 | 0.86 | 0.49 | 0.82 | 0.80 |
| Nb2O5 | 62.72 | 56.91 | 66.63 | 53.79 | 55.59 | 17.18 | 25.20 | 38.56 | 22.79 | 65.28 | 63.97 | 56.28 | 64.67 | 58.36 |
| Ta2O5 | 15.67 | 21.62 | 12.86 | 25.65 | 24.57 | 65.59 | 58.03 | 44.60 | 58.84 | 12.05 | 14.57 | 23.38 | 13.77 | 20.12 |
| SnO2 | 0.08 | 0.06 | 0.09 | 0.11 | 0.08 | 0.16 | 0.05 | 0.20 | 0.17 | 0.16 | 0.18 | 0.13 | 0.10 | 0.18 |
| WO3 | 0.42 | 0.43 | 0.37 | 0.41 | 0.37 | 0.28 | 0.24 | 0.63 | 0.46 | 0.54 | 0.65 | 0.51 | 0.61 | 0.74 |
| PbO | 0.32 | 0.35 | 0.31 | 0.25 | 0.30 | 0.11 | 0.10 | 0.21 | 0.11 | 0.29 | 0.32 | 0.29 | 0.31 | 0.28 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.05 | 0.04 | 0.07 | 0.17 | 0.07 | 0.00 | 0.09 | 0.03 |
| CaO | 0.01 | 0.00 | 0.03 | 0.01 | 0.01 | 0.00 | 0.03 | 0.09 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 |
| Total | 99.46 | 99.06 | 99.79 | 99.14 | 100.09 | 98.54 | 99.64 | 101.48 | 98.61 | 98.60 | 100.07 | 100.10 | 100.08 | 99.44 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.743 | 0.743 | 0.708 | 0.719 | 0.710 | 0.353 | 0.387 | 0.345 | 0.401 | 0.656 | 0.648 | 0.663 | 0.661 | 0.664 |
| Mn | 0.269 | 0.276 | 0.243 | 0.268 | 0.280 | 0.619 | 0.590 | 0.598 | 0.589 | 0.319 | 0.327 | 0.326 | 0.323 | 0.312 |
| Ti | 0.013 | 0.011 | 0.018 | 0.014 | 0.012 | 0.018 | 0.008 | 0.023 | 0.026 | 0.032 | 0.038 | 0.023 | 0.037 | 0.037 |
| Nb | 1.715 | 1.605 | 1.787 | 1.539 | 1.567 | 0.602 | 0.835 | 1.168 | 0.770 | 1.767 | 1.724 | 1.577 | 1.737 | 1.623 |
| Ta | 0.258 | 0.367 | 0.207 | 0.441 | 0.417 | 1.383 | 1.157 | 0.813 | 1.195 | 0.196 | 0.236 | 0.394 | 0.222 | 0.336 |
| Sn | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.005 | 0.001 | 0.005 | 0.005 | 0.004 | 0.004 | 0.003 | 0.002 | 0.005 |
| W | 0.007 | 0.007 | 0.006 | 0.007 | 0.006 | 0.006 | 0.005 | 0.011 | 0.009 | 0.008 | 0.010 | 0.008 | 0.009 | 0.012 |
| Pb | 0.005 | 0.006 | 0.005 | 0.004 | 0.005 | 0.002 | 0.002 | 0.004 | 0.002 | 0.005 | 0.005 | 0.005 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.003 | 0.002 | 0.004 | 0.009 | 0.003 | 0.000 | 0.004 | 0.001 |
| Ca | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.002 | 0.006 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Total | 3.013 | 3.016 | 2.978 | 2.998 | 2.999 | 2.989 | 2.991 | 2.976 | 3.001 | 2.997 | 2.996 | 3.000 | 3.001 | 2.996 |
| Mn/(Mn+Fe) | 0.265 | 0.271 | 0.256 | 0.271 | 0.283 | 0.637 | 0.604 | 0.634 | 0.595 | 0.327 | 0.335 | 0.329 | 0.328 | 0.320 |
| Ta/(Ta+Nb) | 0.131 | 0.186 | 0.104 | 0.223 | 0.210 | 0.697 | 0.581 | 0.410 | 0.608 | 0.100 | 0.120 | 0.200 | 0.114 | 0.172 |
| Comments: | | | | | | | | | | FB & FC<br>same grain | | core | FD - FF<br>same grain | |

|  | Great White North pegmatite |  |  |  |  |  |  |  |  |  |  | Great White North peg. |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 97-GWN4 |  |  |  |  |  |  |  |  |  |  | 97-GWN5 |  |  |  |
|  | RE | RH | RI | EB | EC | ED | EE | EF | EG | EH | EI | KA | KB | KD | KE |
| FeO | 5.79 | 5.37 | 5.14 | 5.61 | 5.83 | 5.95 | 5.62 | 5.83 | 5.82 | 5.87 | 6.13 | 6.44 | 6.17 | 5.79 | 6.74 |
| MnO | 12.77 | 10.76 | 10.63 | 12.57 | 12.51 | 12.97 | 12.70 | 12.00 | 12.00 | 12.11 | 12.27 | 9.10 | 9.62 | 10.33 | 9.99 |
| TiO2 | 0.20 | 0.21 | 0.28 | 0.33 | 0.19 | 0.27 | 0.36 | 0.19 | 0.21 | 0.27 | 0.26 | 0.61 | 0.54 | 0.40 | 0.19 |
| Nb2O5 | 55.16 | 28.08 | 23.53 | 50.00 | 52.84 | 57.59 | 51.70 | 46.64 | 46.92 | 47.62 | 52.78 | 22.31 | 23.37 | 25.12 | 31.57 |
| Ta2O5 | 25.14 | 52.30 | 58.96 | 29.40 | 27.37 | 22.51 | 27.85 | 34.35 | 33.21 | 33.10 | 27.01 | 58.47 | 57.74 | 56.10 | 50.57 |
| SnO2 | 0.02 | 1.09 | 0.55 | 0.09 | 0.07 | 0.05 | 0.16 | 0.02 | 0.02 | 0.08 | 0.08 | 0.39 | 0.43 | 0.24 | 0.05 |
| WO3 | 0.19 | 0.61 | 0.52 | 0.70 | 0.44 | 0.29 | 0.99 | 0.41 | 0.38 | 0.51 | 0.32 | 0.45 | 0.72 | 0.64 | 0.58 |
| PbO | 0.26 | 0.19 | 0.05 | 0.23 | 0.24 | 0.23 | 0.27 | 0.21 | 0.22 | 0.24 | 0.23 | 0.26 | 0.10 | 0.12 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.33 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | 0.03 | 0.04 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.06 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| CaO | 0.03 | 0.01 | 0.00 | 0.04 | 0.03 | 0.03 | 0.02 | 0.03 | 0.03 | 0.02 | 0.04 | 0.06 | 0.01 | 0.00 | 0.00 |
| Total | 99.64 | 98.70 | 99.64 | 98.97 | 99.52 | 99.89 | 99.70 | 99.67 | 98.81 | 99.87 | 99.21 | 98.39 | 98.68 | 98.75 | 99.82 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.304 | 0.326 | 0.317 | 0.303 | 0.309 | 0.307 | 0.299 | 0.318 | 0.319 | 0.318 | 0.326 | 0.404 | 0.383 | 0.357 | 0.398 |
| Mn | 0.678 | 0.661 | 0.665 | 0.686 | 0.672 | 0.679 | 0.683 | 0.664 | 0.668 | 0.665 | 0.660 | 0.579 | 0.606 | 0.645 | 0.598 |
| Ti | 0.010 | 0.012 | 0.015 | 0.016 | 0.009 | 0.013 | 0.017 | 0.009 | 0.010 | 0.013 | 0.013 | 0.034 | 0.030 | 0.022 | 0.010 |
| Nb | 1.563 | 0.921 | 0.786 | 1.457 | 1.515 | 1.608 | 1.485 | 1.378 | 1.393 | 1.396 | 1.516 | 0.757 | 0.785 | 0.837 | 1.008 |
| Ta | 0.429 | 1.032 | 1.184 | 0.515 | 0.472 | 0.378 | 0.481 | 0.611 | 0.593 | 0.584 | 0.467 | 1.194 | 1.167 | 1.124 | 0.971 |
| Sn | 0.001 | 0.032 | 0.016 | 0.002 | 0.002 | 0.001 | 0.004 | 0.000 | 0.001 | 0.002 | 0.002 | 0.012 | 0.013 | 0.007 | 0.001 |
| W | 0.003 | 0.011 | 0.010 | 0.012 | 0.007 | 0.005 | 0.016 | 0.007 | 0.007 | 0.009 | 0.005 | 0.009 | 0.014 | 0.012 | 0.011 |
| Pb | 0.004 | 0.004 | 0.001 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.004 | 0.005 | 0.002 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.003 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ca | 0.002 | 0.000 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.005 | 0.000 | 0.000 | 0.000 |
| Total | 2.995 | 3.002 | 2.994 | 2.999 | 2.993 | 2.997 | 2.995 | 2.994 | 2.997 | 2.996 | 2.999 | 3.004 | 3.001 | 3.006 | 2.999 |
| Mn/(Mn+Fe) | 0.691 | 0.670 | 0.677 | 0.694 | 0.685 | 0.688 | 0.696 | 0.676 | 0.676 | 0.676 | 0.670 | 0.589 | 0.612 | 0.644 | 0.600 |
| Ta/(Ta+Nb) | 0.215 | 0.528 | 0.601 | 0.261 | 0.238 | 0.190 | 0.245 | 0.307 | 0.299 | 0.295 | 0.235 | 0.612 | 0.598 | 0.573 | 0.491 |
| Comments: |  | RH & RI<br>same grain |  |  |  | ED & EE<br>same grain<br>patchy zoned |  |  | EF - EH<br>same grain<br>patchy zoned |  |  |  | KA - KE<br>same grain |  |  |

|  | **Great White North peg.** |  |  |  | **Great White North peg.** |  |  | **Pegmatite 7** |  |  | **Pegmatite 10** |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 97-GWN5 |  |  |  | 97-GWN6 |  |  | 97-P7-1 |  |  | 97-P10 |  |  |  |
|  | KF | KG | KI | KJ | MC | MI | MJ | SM | SO | SP | RC | RD | JA | JM |
| FeO | 7.78 | 7.61 | 3.53 | 3.35 | 11.37 | 10.85 | 8.86 | 10.17 | 10.50 | 10.11 | 14.20 | 15.10 | 13.60 | 14.71 |
| MnO | 9.98 | 9.90 | 12.88 | 12.91 | 6.63 | 4.51 | 3.80 | 5.03 | 4.72 | 4.94 | 3.81 | 3.75 | 3.66 | 3.29 |
| TiO2 | 0.49 | 0.61 | 0.32 | 0.35 | 0.27 | 0.79 | 0.70 | 3.88 | 4.12 | 3.21 | 1.12 | 1.23 | 1.20 | 2.60 |
| Nb2O5 | 43.78 | 41.75 | 25.88 | 26.02 | 48.32 | 20.84 | 28.23 | 25.73 | 23.72 | 24.26 | 37.46 | 50.94 | 39.22 | 49.34 |
| Ta2O5 | 36.52 | 37.81 | 55.90 | 55.48 | 31.25 | 60.30 | 52.14 | 48.30 | 48.35 | 47.18 | 41.90 | 28.09 | 40.29 | 25.60 |
| SnO2 | 0.24 | 0.34 | 0.16 | 0.16 | 0.02 | 0.44 | 0.71 | 4.69 | 5.72 | 4.81 | 0.55 | 0.36 | 0.47 | 0.87 |
| WO3 | 0.63 | 0.54 | 0.54 | 0.65 | 0.41 | 0.33 | 0.43 | 1.73 | 2.25 | 3.51 | 0.81 | 0.55 | 0.84 | 1.36 |
| PbO | 0.20 | 0.27 | 0.09 | 0.10 | 0.23 | 0.16 | 0.16 | 0.07 | 0.12 | 0.14 | 0.19 | 0.22 | 0.41 | 0.53 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.03 | 0.12 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.21 | 0.02 | 0.11 | 0.11 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.06 | 0.06 | 0.06 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |  |  |
| Sc2O3 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.29 | 0.23 | 0.32 | 0.05 | 0.23 | 0.03 | 0.68 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 3.60 | 0.03 | 0.04 | 0.03 | 0.03 | 0.03 | 0.12 | 0.12 |
| Total | 99.65 | 99.02 | 99.30 | 99.04 | 98.53 | 98.32 | 98.71 | 99.91 | 99.75 | 98.50 | 100.39 | 100.58 | 100.01 | 99.27 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.430 | 0.427 | 0.215 | 0.205 | 0.622 | 0.686 | 0.529 | 0.593 | 0.617 | 0.604 | 0.801 | 0.794 | 0.763 | 0.776 |
| Mn | 0.559 | 0.562 | 0.797 | 0.799 | 0.367 | 0.289 | 0.230 | 0.297 | 0.281 | 0.299 | 0.218 | 0.200 | 0.208 | 0.176 |
| Ti | 0.024 | 0.031 | 0.018 | 0.019 | 0.013 | 0.045 | 0.038 | 0.204 | 0.218 | 0.172 | 0.057 | 0.058 | 0.061 | 0.123 |
| Nb | 1.309 | 1.266 | 0.854 | 0.860 | 1.428 | 0.713 | 0.912 | 0.811 | 0.754 | 0.783 | 1.142 | 1.447 | 1.190 | 1.406 |
| Ta | 0.657 | 0.690 | 1.110 | 1.103 | 0.555 | 1.240 | 1.014 | 0.916 | 0.925 | 0.916 | 0.769 | 0.480 | 0.735 | 0.439 |
| Sn | 0.006 | 0.009 | 0.005 | 0.005 | 0.001 | 0.013 | 0.020 | 0.130 | 0.160 | 0.137 | 0.015 | 0.009 | 0.013 | 0.022 |
| W | 0.011 | 0.009 | 0.010 | 0.012 | 0.007 | 0.006 | 0.008 | 0.031 | 0.041 | 0.065 | 0.014 | 0.009 | 0.015 | 0.022 |
| Pb | 0.004 | 0.005 | 0.002 | 0.002 | 0.004 | 0.003 | 0.003 | 0.001 | 0.002 | 0.003 | 0.003 | 0.004 | 0.007 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.002 | 0.002 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.002 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |  |  |  |  |  |  |  |
| Sc | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.018 | 0.014 | 0.020 | 0.003 | 0.013 | 0.002 | 0.037 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.275 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.009 | 0.008 |
| Total | 3.000 | 3.004 | 3.011 | 3.006 | 2.998 | 2.999 | 3.035 | 3.004 | 3.015 | 3.001 | 3.028 | 3.017 | 3.006 | 3.021 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mn/(Mn+Fe) | 0.565 | 0.569 | 0.787 | 0.796 | 0.371 | 0.296 | 0.303 | 0.334 | 0.313 | 0.331 | 0.214 | 0.201 | 0.214 | 0.185 |
| Ta/(Ta+Nb) | 0.334 | 0.353 | 0.565 | 0.562 | 0.280 | 0.635 | 0.526 | 0.530 | 0.551 | 0.539 | 0.402 | 0.249 | 0.382 | 0.238 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | KF & KG<br>same grain |  | incl.<br>in garnet |  |  | MI & MJ<br>same grain<br>close to micaceous selvedge |  | SM - SP same grain<br>replaces wodginite |  |  |  |  |  |  |

**Pegmatite 10**

97-P10-1

| | VR | VX | VY | VZ | WC | WE | WF | WG | WI | WJ | WK | WP | WR | WS | JJ | JK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.75 | 14.46 | 14.30 | 13.02 | 14.18 | 14.59 | 14.18 | 14.75 | 14.98 | 14.94 | 14.04 | 13.19 | 13.44 | 13.68 | 13.29 | 13.33 |
| MnO | 2.43 | 2.82 | 2.76 | 3.14 | 2.36 | 2.02 | 2.43 | 2.64 | 2.94 | 2.98 | 3.00 | 3.12 | 3.04 | 3.05 | 2.82 | 3.01 |
| TiO2 | 2.42 | 0.77 | 0.78 | 1.31 | 1.78 | 2.07 | 2.13 | 0.78 | 0.83 | 0.85 | 1.08 | 1.13 | 0.80 | 1.15 | 1.06 | 0.66 |
| Nb2O5 | 27.92 | 37.41 | 34.34 | 34.70 | 31.26 | 31.59 | 31.31 | 39.43 | 45.33 | 45.46 | 35.51 | 28.02 | 28.98 | 31.29 | 26.58 | 26.72 |
| Ta2O5 | 50.63 | 42.50 | 45.84 | 44.31 | 47.94 | 47.51 | 46.66 | 41.04 | 33.25 | 33.20 | 44.26 | 51.56 | 52.72 | 49.30 | 54.23 | 54.66 |
| SnO2 | 0.75 | 0.21 | 0.10 | 0.41 | 0.78 | 0.73 | 0.75 | 0.16 | 0.12 | 0.15 | 0.27 | 0.39 | 0.22 | 0.30 | 0.23 | 0.16 |
| WO3 | 1.40 | 1.22 | 1.25 | 1.44 | 0.98 | 1.10 | 1.17 | 1.28 | 1.41 | 1.29 | 1.44 | 1.06 | 0.51 | 0.82 | 0.95 | 0.80 |
| PbO | 0.18 | 0.14 | 0.09 | 0.16 | 0.20 | 0.13 | 0.14 | 0.15 | 0.22 | 0.20 | 0.20 | 0.19 | 0.06 | 0.19 | 0.10 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.12 | 0.15 | 0.06 | 0.32 | 0.02 | 0.01 | 0.12 | 0.11 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.05 | 0.11 | 0.00 |
| CaO | 0.00 | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.62 | 99.67 | 99.51 | 99.38 | 99.48 | 99.75 | 98.90 | 100.33 | 99.12 | 99.08 | 99.92 | 98.94 | 99.78 | 99.83 | 99.36 | 99.47 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.811 | 0.823 | 0.829 | 0.747 | 0.828 | 0.846 | 0.828 | 0.827 | 0.822 | 0.820 | 0.804 | 0.793 | 0.801 | 0.801 | 0.802 | 0.807 |
| Mn | 0.145 | 0.163 | 0.162 | 0.183 | 0.140 | 0.119 | 0.144 | 0.150 | 0.163 | 0.166 | 0.174 | 0.190 | 0.183 | 0.181 | 0.172 | 0.185 |
| Ti | 0.128 | 0.039 | 0.040 | 0.067 | 0.093 | 0.108 | 0.112 | 0.039 | 0.041 | 0.042 | 0.056 | 0.061 | 0.043 | 0.061 | 0.057 | 0.036 |
| Nb | 0.890 | 1.151 | 1.076 | 1.077 | 0.987 | 0.990 | 0.988 | 1.195 | 1.346 | 1.349 | 1.099 | 0.911 | 0.933 | 0.991 | 0.868 | 0.875 |
| Ta | 0.971 | 0.787 | 0.864 | 0.827 | 0.910 | 0.896 | 0.886 | 0.748 | 0.594 | 0.592 | 0.824 | 1.008 | 1.022 | 0.939 | 1.065 | 1.077 |
| Sn | 0.021 | 0.006 | 0.003 | 0.011 | 0.022 | 0.020 | 0.021 | 0.004 | 0.003 | 0.004 | 0.007 | 0.011 | 0.006 | 0.008 | 0.007 | 0.005 |
| W | 0.026 | 0.022 | 0.022 | 0.026 | 0.018 | 0.020 | 0.021 | 0.022 | 0.024 | 0.022 | 0.025 | 0.020 | 0.009 | 0.015 | 0.018 | 0.015 |
| Pb | 0.003 | 0.002 | 0.002 | 0.003 | 0.004 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 | 0.001 | 0.004 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.007 | 0.009 | 0.004 | 0.019 | 0.001 | 0.000 | 0.007 | 0.006 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.003 | 0.007 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.043 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.004 | 3.001 | 3.001 | 3.004 | 3.003 | 3.002 | 3.010 | 2.994 | 2.999 | 2.999 | 2.999 | 3.008 | 2.999 | 3.004 | 2.998 | 3.002 |
| Mn/(Mn+Fe) | 0.152 | 0.165 | 0.164 | 0.196 | 0.144 | 0.123 | 0.148 | 0.153 | 0.166 | 0.168 | 0.178 | 0.193 | 0.186 | 0.184 | 0.177 | 0.186 |
| Ta/(Ta+Nb) | 0.522 | 0.406 | 0.445 | 0.434 | 0.480 | 0.475 | 0.473 | 0.385 | 0.306 | 0.305 | 0.429 | 0.525 | 0.523 | 0.487 | 0.551 | 0.552 |
| Comments: | | columbite core with<br>irregular wodginite rim | | | | WC - WG<br>same grain<br>wodginite & microlite incls. in this grain | | | WI & WJ<br>same grain | | | WP & WQ<br>same grain | WR & WS<br>same grain<br>patchy zonation | | JJ & JK<br>same grain | |

|  |  |  |  |  |  | **Pegmatite 10** |  |  |  |  |  |  |  | **Pegmatite 10** |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  | 97-P10-2 |  |  |  |  |  |  |  | 97-P10-3 |  |  |
|  | LA | LB | LH | LL | LM | LN | LT | LU | LV | LX | LY | LZ | ND | NN | NQ | NS |
| FeO | 13.32 | 13.66 | 14.81 | 14.05 | 14.57 | 15.85 | 12.98 | 12.31 | 15.61 | 14.86 | 13.40 | 14.48 | 13.52 | 14.90 | 14.96 | 16.24 |
| MnO | 3.18 | 2.73 | 2.46 | 2.33 | 2.36 | 2.49 | 3.09 | 4.06 | 2.81 | 2.73 | 2.60 | 2.69 | 1.69 | 1.86 | 2.33 | 2.61 |
| TiO2 | 0.33 | 0.33 | 1.04 | 0.43 | 0.81 | 0.86 | 0.39 | 0.61 | 0.76 | 0.74 | 0.74 | 0.75 | 0.71 | 1.52 | 1.12 | 0.71 |
| Nb2O5 | 28.46 | 28.02 | 37.84 | 28.58 | 34.53 | 50.24 | 24.44 | 28.44 | 49.67 | 41.40 | 23.57 | 36.16 | 23.19 | 36.25 | 36.77 | 51.79 |
| Ta2O5 | 52.49 | 53.30 | 40.90 | 52.55 | 45.19 | 28.41 | 57.31 | 52.31 | 28.76 | 38.06 | 57.94 | 43.63 | 56.90 | 43.16 | 42.25 | 27.39 |
| SnO2 | 0.14 | 0.16 | 0.22 | 0.11 | 0.22 | 0.19 | 0.17 | 0.25 | 0.11 | 0.14 | 0.17 | 0.22 | 1.03 | 0.22 | 0.25 | 0.13 |
| WO3 | 0.69 | 0.71 | 1.46 | 0.72 | 1.29 | 1.50 | 0.78 | 0.91 | 1.34 | 1.14 | 0.69 | 0.92 | 0.75 | 1.09 | 1.53 | 1.39 |
| PbO | 0.19 | 0.10 | 0.14 | 0.08 | 0.14 | 0.26 | 0.17 | 0.21 | 0.24 | 0.18 | 0.08 | 0.13 | 0.12 | 0.16 | 0.17 | 0.23 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.06 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.02 | 0.02 | 0.00 | 0.07 | 0.00 | 0.02 | 0.07 | 0.00 | 0.00 | 0.01 |
| CaO | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 |
| Total | 98.82 | 99.06 | 98.87 | 98.89 | 99.16 | 99.87 | 99.33 | 99.12 | 99.32 | 99.32 | 99.20 | 99.00 | 98.00 | 99.19 | 99.52 | 100.52 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.806 | 0.827 | 0.845 | 0.849 | 0.846 | 0.844 | 0.800 | 0.741 | 0.838 | 0.832 | 0.827 | 0.835 | 0.845 | 0.852 | 0.853 | 0.855 |
| Mn | 0.195 | 0.167 | 0.142 | 0.142 | 0.139 | 0.135 | 0.193 | 0.248 | 0.153 | 0.155 | 0.163 | 0.157 | 0.107 | 0.108 | 0.134 | 0.139 |
| Ti | 0.018 | 0.018 | 0.053 | 0.023 | 0.042 | 0.041 | 0.021 | 0.033 | 0.037 | 0.037 | 0.041 | 0.039 | 0.040 | 0.078 | 0.057 | 0.034 |
| Nb | 0.931 | 0.917 | 1.167 | 0.933 | 1.084 | 1.446 | 0.814 | 0.925 | 1.441 | 1.253 | 0.787 | 1.128 | 0.784 | 1.121 | 1.134 | 1.474 |
| Ta | 1.033 | 1.049 | 0.759 | 1.032 | 0.854 | 0.492 | 1.148 | 1.024 | 0.502 | 0.693 | 1.164 | 0.818 | 1.157 | 0.803 | 0.784 | 0.469 |
| Sn | 0.004 | 0.005 | 0.006 | 0.003 | 0.006 | 0.005 | 0.005 | 0.007 | 0.003 | 0.004 | 0.005 | 0.006 | 0.031 | 0.006 | 0.007 | 0.003 |
| W | 0.013 | 0.013 | 0.026 | 0.013 | 0.023 | 0.025 | 0.015 | 0.017 | 0.022 | 0.020 | 0.013 | 0.016 | 0.015 | 0.019 | 0.027 | 0.023 |
| Pb | 0.004 | 0.002 | 0.003 | 0.002 | 0.003 | 0.005 | 0.003 | 0.004 | 0.004 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.001 | 0.000 | 0.004 | 0.000 | 0.001 | 0.005 | 0.000 | 0.000 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 |
| Total | 3.006 | 3.000 | 3.000 | 2.998 | 2.998 | 2.996 | 3.000 | 3.001 | 3.001 | 2.999 | 3.002 | 3.003 | 2.987 | 2.991 | 3.002 | 3.002 |
| Mn/(Mn+Fe) | 0.195 | 0.168 | 0.144 | 0.144 | 0.141 | 0.137 | 0.194 | 0.251 | 0.154 | 0.157 | 0.164 | 0.158 | 0.112 | 0.112 | 0.136 | 0.140 |
| Ta/(Ta+Nb) | 0.526 | 0.534 | 0.394 | 0.525 | 0.441 | 0.254 | 0.585 | 0.525 | 0.258 | 0.356 | 0.597 | 0.421 | 0.596 | 0.417 | 0.409 | 0.241 |
| Comments: | LA & LB |  |  |  | LL - LN |  |  | LT - LV |  |  | LX - LZ |  | ND inclusion |  | NQ & NS |  |
|  | same grain |  |  |  | same grain |  |  | same grain |  |  | same grain |  | in cassiterite |  | inclusions |  |
|  |  |  |  | core | mid | rim |  | no zoning |  |  | patchy zoned |  |  |  | in garnet |  |

|  | Pegmatite 10 |  |  |  |  |  |  |  |  | Pegmatite 10 |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 97-P10-4 |  |  |  |  |  |  |  |  | 97-P10-5 |  |  |  |  |  |
|  | MA | MB | ME | MF | MM | MN | MS | MT | MU | WF | WG | WH | WI | WK | WL |
| FeO | 14.56 | 14.32 | 14.35 | 14.18 | 14.03 | 14.10 | 14.40 | 14.00 | 15.53 | 14.88 | 14.95 | 14.82 | 14.82 | 15.11 | 15.50 |
| MnO | 2.98 | 3.01 | 2.93 | 3.10 | 3.25 | 3.10 | 2.36 | 2.50 | 2.57 | 2.48 | 2.80 | 2.52 | 2.51 | 2.69 | 2.84 |
| TiO2 | 2.73 | 1.39 | 0.85 | 0.80 | 0.71 | 0.85 | 0.76 | 0.58 | 0.67 | 2.76 | 1.60 | 2.32 | 2.80 | 1.78 | 1.23 |
| Nb2O5 | 41.22 | 37.09 | 35.19 | 36.06 | 38.06 | 38.57 | 31.53 | 28.82 | 46.14 | 36.95 | 39.85 | 38.46 | 38.80 | 42.27 | 47.16 |
| Ta2O5 | 34.02 | 41.23 | 43.98 | 43.92 | 41.08 | 40.46 | 47.93 | 51.51 | 33.31 | 39.26 | 37.68 | 39.23 | 37.85 | 34.34 | 30.27 |
| SnO2 | 0.68 | 0.31 | 0.18 | 0.17 | 0.18 | 0.18 | 0.26 | 0.25 | 0.11 | 1.07 | 0.33 | 0.81 | 0.87 | 0.64 | 0.49 |
| WO3 | 2.17 | 1.60 | 1.61 | 1.62 | 1.40 | 1.39 | 1.30 | 1.19 | 1.10 | 1.61 | 2.39 | 1.25 | 1.81 | 1.63 | 1.89 |
| PbO | 0.21 | 0.16 | 0.19 | 0.13 | 0.15 | 0.14 | 0.25 | 0.14 | 0.15 | 0.18 | 0.11 | 0.20 | 0.21 | 0.34 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.03 | 0.06 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.25 | 0.00 |
| Sb2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.44 | 0.07 | 0.01 | 0.00 | 0.09 | 0.05 | 0.07 | 0.00 | 0.01 | 0.09 | 0.18 | 0.24 | 0.27 | 0.01 | 0.05 |
| CaO | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 |
| Total | 99.03 | 99.18 | 99.29 | 99.99 | 98.95 | 98.87 | 98.91 | 99.12 | 99.60 | 99.27 | 99.89 | 99.84 | 99.93 | 99.08 | 99.66 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.799 | 0.815 | 0.829 | 0.811 | 0.801 | 0.803 | 0.852 | 0.841 | 0.847 | 0.835 | 0.831 | 0.825 | 0.819 | 0.836 | 0.835 |
| Mn | 0.166 | 0.173 | 0.171 | 0.180 | 0.188 | 0.179 | 0.141 | 0.152 | 0.142 | 0.141 | 0.158 | 0.142 | 0.141 | 0.151 | 0.155 |
| Ti | 0.135 | 0.071 | 0.044 | 0.041 | 0.036 | 0.043 | 0.040 | 0.032 | 0.033 | 0.139 | 0.080 | 0.116 | 0.139 | 0.089 | 0.060 |
| Nb | 1.223 | 1.141 | 1.099 | 1.115 | 1.175 | 1.187 | 1.008 | 0.936 | 1.361 | 1.121 | 1.197 | 1.157 | 1.159 | 1.264 | 1.374 |
| Ta | 0.607 | 0.763 | 0.826 | 0.817 | 0.763 | 0.749 | 0.922 | 1.006 | 0.591 | 0.716 | 0.681 | 0.710 | 0.680 | 0.618 | 0.531 |
| Sn | 0.018 | 0.008 | 0.005 | 0.005 | 0.005 | 0.005 | 0.007 | 0.007 | 0.003 | 0.029 | 0.009 | 0.022 | 0.023 | 0.017 | 0.013 |
| W | 0.037 | 0.028 | 0.029 | 0.029 | 0.025 | 0.025 | 0.024 | 0.022 | 0.019 | 0.028 | 0.041 | 0.022 | 0.031 | 0.028 | 0.032 |
| Pb | 0.004 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 | 0.005 | 0.003 | 0.003 | 0.003 | 0.002 | 0.004 | 0.004 | 0.006 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.025 | 0.004 | 0.000 | 0.000 | 0.005 | 0.003 | 0.004 | 0.000 | 0.000 | 0.005 | 0.010 | 0.014 | 0.015 | 0.000 | 0.003 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| Total | 3.014 | 3.007 | 3.006 | 2.999 | 3.001 | 2.997 | 3.006 | 3.001 | 2.999 | 3.017 | 3.008 | 3.011 | 3.010 | 3.012 | 3.006 |
| Mn/(Mn+Fe) | 0.172 | 0.175 | 0.171 | 0.181 | 0.190 | 0.182 | 0.142 | 0.153 | 0.144 | 0.144 | 0.160 | 0.147 | 0.147 | 0.153 | 0.157 |
| Ta/(Ta+Nb) | 0.332 | 0.401 | 0.429 | 0.423 | 0.394 | 0.387 | 0.478 | 0.518 | 0.303 | 0.390 | 0.363 | 0.380 | 0.370 | 0.328 | 0.279 |
| Comments: | MA & MB<br>same grain<br>col./cass./nigerite-rich sample |  | ME & MF<br>same grain |  | MM & MN<br>same grain |  |  | MS - MU<br>same grain |  | WF - WI<br>same grain<br>columbite associated with more abundant cassiterite |  |  |  | WK & WL<br>same grain |  |

|  | Swamp pegmatite |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 97-SP1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | NA | NB | NC | JA | JB | JC | JD | JM | JN | JQ | JR | AH | AI | AR | AU | AX | AY |
| FeO | 0.87 | 0.91 | 0.87 | 0.82 | 0.81 | 0.81 | 0.80 | 0.47 | 0.69 | 0.93 | 0.91 | 0.69 | 0.73 | 0.80 | 0.77 | 0.72 | 0.78 |
| MnO | 13.57 | 14.67 | 14.62 | 14.34 | 14.53 | 14.62 | 14.73 | 15.04 | 15.99 | 15.91 | 14.60 | 14.44 | 13.93 | 14.30 | 14.11 | 14.82 | 14.85 |
| TiO2 | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.60 | 0.26 | 0.00 | 0.25 | 0.03 | 0.02 | 0.01 | 0.02 | 0.06 |
| Nb2O5 | 13.33 | 26.58 | 23.49 | 18.90 | 20.33 | 23.03 | 23.65 | 25.00 | 37.81 | 37.87 | 23.06 | 20.76 | 14.05 | 19.63 | 16.99 | 23.41 | 25.96 |
| Ta2O5 | 71.32 | 56.74 | 59.50 | 65.00 | 63.20 | 60.20 | 59.42 | 58.59 | 42.97 | 43.98 | 60.73 | 62.47 | 71.16 | 63.79 | 67.20 | 60.14 | 56.86 |
| SnO2 | 0.36 | 0.21 | 0.04 | 0.05 | 0.16 | 0.00 | 0.14 | 0.11 | 0.59 | 0.16 | 0.07 | 0.27 | 0.07 | 0.02 | 0.06 | 0.08 | 0.09 |
| WO3 | 0.19 | 0.28 | 0.27 | 0.25 | 0.30 | 0.17 | 0.23 | 0.21 | 0.67 | 0.64 | 0.23 | 0.30 | 0.32 | 0.22 | 0.20 | 0.27 | 0.28 |
| PbO | 0.08 | 0.13 | 0.05 | 0.01 | 0.11 | 0.09 | 0.03 | 0.14 | 0.29 | 0.20 | 0.07 | 0.27 | 0.15 | 0.21 | 0.26 | 0.29 | 0.28 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | 0.00 | 0.04 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.06 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.02 | 0.02 | 0.30 | 0.09 |
| CaO | 0.00 | 0.00 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 | 0.01 | 0.00 | 0.02 | 0.02 | 0.02 | 0.02 | 0.01 | 0.02 | 0.01 |
| Total | 99.72 | 99.57 | 98.87 | 99.53 | 99.45 | 98.96 | 99.01 | 99.59 | 99.67 | 99.94 | 99.70 | 99.59 | 100.44 | 99.05 | 99.68 | 100.06 | 99.26 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.057 | 0.055 | 0.054 | 0.052 | 0.051 | 0.051 | 0.050 | 0.029 | 0.039 | 0.053 | 0.056 | 0.043 | 0.047 | 0.051 | 0.050 | 0.045 | 0.048 |
| Mn | 0.904 | 0.906 | 0.924 | 0.925 | 0.931 | 0.926 | 0.929 | 0.937 | 0.923 | 0.919 | 0.919 | 0.920 | 0.918 | 0.924 | 0.921 | 0.927 | 0.923 |
| Ti | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.030 | 0.013 | 0.000 | 0.014 | 0.002 | 0.001 | 0.001 | 0.001 | 0.004 |
| Nb | 0.474 | 0.876 | 0.793 | 0.651 | 0.695 | 0.779 | 0.796 | 0.832 | 1.165 | 1.167 | 0.775 | 0.706 | 0.495 | 0.677 | 0.592 | 0.781 | 0.861 |
| Ta | 1.527 | 1.125 | 1.208 | 1.346 | 1.300 | 1.225 | 1.203 | 1.172 | 0.796 | 0.815 | 1.227 | 1.277 | 1.507 | 1.323 | 1.409 | 1.207 | 1.134 |
| Sn | 0.011 | 0.006 | 0.001 | 0.002 | 0.005 | 0.000 | 0.004 | 0.003 | 0.016 | 0.004 | 0.002 | 0.008 | 0.002 | 0.001 | 0.002 | 0.002 | 0.003 |
| W | 0.004 | 0.005 | 0.005 | 0.005 | 0.006 | 0.003 | 0.004 | 0.004 | 0.012 | 0.011 | 0.004 | 0.006 | 0.006 | 0.004 | 0.004 | 0.005 | 0.005 |
| Pb | 0.002 | 0.003 | 0.001 | 0.000 | 0.002 | 0.002 | 0.001 | 0.003 | 0.005 | 0.004 | 0.001 | 0.006 | 0.003 | 0.004 | 0.005 | 0.006 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.001 | 0.001 | 0.019 | 0.006 |
| Ca | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 | 0.000 |
| Total | 2.980 | 2.979 | 2.988 | 2.990 | 2.991 | 2.988 | 2.988 | 2.982 | 2.988 | 2.987 | 2.986 | 2.988 | 2.981 | 2.989 | 2.987 | 2.994 | 2.988 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Mn/(Mn+Fe) | 0.941 | 0.942 | 0.944 | 0.946 | 0.948 | 0.948 | 0.949 | 0.970 | 0.959 | 0.945 | 0.942 | 0.955 | 0.951 | 0.948 | 0.949 | 0.954 | 0.951 |
| Ta/(Ta+Nb) | 0.763 | 0.562 | 0.604 | 0.674 | 0.652 | 0.611 | 0.602 | 0.585 | 0.406 | 0.411 | 0.613 | 0.644 | 0.753 | 0.662 | 0.704 | 0.607 | 0.569 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | NA & NB |  |  |  |  | JB - JD |  | JM & JN |  |  |  | AH - AY from large block sent in 1999 |  |  |  |  |  |
|  | same grain |  |  |  |  | same grain |  | same grain |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | some zoning |  | oscillatory zoned |  |  |  |  |  |  |  |  |  |

| | West pegmatite | | | | West pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 97-WP1 | | | | 97-WP2 | | | | | |
| | QG | QM | QN | QR | CC | CD | CE | CF | SE | SF |
| FeO | 14.78 | 13.99 | 13.90 | 13.81 | 12.77 | 12.98 | 12.52 | 12.00 | 12.04 | 12.71 |
| MnO | 3.85 | 3.45 | 3.58 | 3.56 | 3.75 | 3.84 | 4.11 | 4.75 | 3.75 | 3.77 |
| TiO2 | 0.79 | 0.64 | 0.34 | 0.22 | 0.66 | 0.75 | 0.54 | 0.56 | 0.65 | 0.55 |
| Nb2O5 | 50.40 | 34.78 | 36.46 | 35.77 | 29.50 | 32.17 | 30.06 | 30.36 | 28.47 | 30.95 |
| Ta2O5 | 28.13 | 45.92 | 45.21 | 46.11 | 51.83 | 50.26 | 50.98 | 51.08 | 52.21 | 51.26 |
| SnO2 | 0.24 | 0.26 | 0.17 | 0.08 | 0.94 | 0.25 | 0.87 | 0.94 | 0.28 | 0.14 |
| WO3 | 0.50 | 0.44 | 0.31 | 0.22 | 0.37 | 0.42 | 0.47 | 0.54 | 0.59 | 0.55 |
| PbO | 0.26 | 0.11 | 0.17 | 0.16 | 0.14 | 0.17 | 0.13 | 0.14 | 0.29 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.16 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.14 | 0.11 | 0.05 | 0.00 | 0.04 | 0.00 | 0.19 | 0.00 |
| CaO | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.00 | 0.08 | 0.00 |
| Total | 98.96 | 99.59 | 100.27 | 100.04 | 100.01 | 100.87 | 99.73 | 100.37 | 98.69 | 100.05 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | |
| Fe | 0.793 | 0.810 | 0.795 | 0.796 | 0.758 | 0.754 | 0.743 | 0.707 | 0.728 | 0.750 |
| Mn | 0.209 | 0.202 | 0.207 | 0.208 | 0.225 | 0.226 | 0.247 | 0.284 | 0.229 | 0.225 |
| Ti | 0.038 | 0.033 | 0.017 | 0.011 | 0.035 | 0.039 | 0.029 | 0.030 | 0.035 | 0.029 |
| Nb | 1.461 | 1.088 | 1.128 | 1.114 | 0.946 | 1.010 | 0.964 | 0.967 | 0.930 | 0.987 |
| Ta | 0.491 | 0.864 | 0.841 | 0.864 | 1.000 | 0.950 | 0.984 | 0.979 | 1.026 | 0.983 |
| Sn | 0.006 | 0.007 | 0.005 | 0.002 | 0.027 | 0.007 | 0.024 | 0.026 | 0.008 | 0.004 |
| W | 0.008 | 0.008 | 0.005 | 0.004 | 0.007 | 0.008 | 0.009 | 0.010 | 0.011 | 0.010 |
| Pb | 0.004 | 0.002 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.006 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.008 | 0.006 | 0.003 | 0.000 | 0.002 | 0.000 | 0.012 | 0.000 |
| Ca | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.007 | 0.000 |
| Total | 3.012 | 3.015 | 3.010 | 3.009 | 3.004 | 2.999 | 3.006 | 3.005 | 2.993 | 2.991 |
| Mn/(Mn+Fe) | 0.209 | 0.200 | 0.207 | 0.207 | 0.229 | 0.230 | 0.249 | 0.286 | 0.240 | 0.231 |
| Ta/(Ta+Nb) | 0.251 | 0.443 | 0.427 | 0.437 | 0.514 | 0.485 | 0.505 | 0.503 | 0.525 | 0.499 |
| Comments: | | tiny grains | | | CC & CD<br>same grain | | CE & CF<br>same grain | | | |

| | | | | | | **West pegmatite** | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 97-WP3 | | | | | | | |
| | DF | DG | DH | DI | DM | DN | DQ | DT | DU | DV | NJ | NP | NQ |
| FeO | 9.47 | 2.81 | 9.28 | 8.76 | 7.88 | 8.08 | 8.03 | 6.45 | 9.38 | 8.96 | 8.62 | 8.35 | 7.93 |
| MnO | 9.48 | 16.46 | 9.61 | 10.57 | 9.09 | 9.31 | 9.34 | 12.15 | 9.54 | 9.43 | 9.46 | 10.55 | 9.26 |
| TiO2 | 0.29 | 0.80 | 0.25 | 0.36 | 0.37 | 0.50 | 0.30 | 0.22 | 0.20 | 0.29 | 0.25 | 0.45 | 0.23 |
| Nb2O5 | 53.75 | 61.50 | 53.30 | 61.04 | 35.74 | 39.90 | 39.63 | 51.59 | 54.25 | 49.75 | 49.31 | 57.00 | 45.74 |
| Ta2O5 | 26.23 | 16.87 | 25.78 | 18.42 | 45.28 | 40.88 | 41.81 | 28.90 | 26.07 | 30.78 | 30.45 | 22.68 | 35.79 |
| SnO2 | 0.04 | 0.07 | 0.05 | 0.13 | 0.41 | 0.33 | 0.32 | 0.04 | 0.07 | 0.07 | 0.06 | 0.17 | 0.10 |
| WO3 | 0.37 | 0.49 | 0.34 | 0.37 | 0.52 | 0.29 | 0.37 | 0.41 | 0.41 | 0.41 | 0.28 | 0.31 | 0.17 |
| PbO | 0.24 | 0.30 | 0.26 | 0.28 | 0.25 | 0.24 | 0.24 | 0.27 | 0.33 | 0.25 | 0.29 | 0.27 | 0.15 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.04 | 0.06 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.04 | 0.07 | 0.00 | 0.08 | 0.00 |
| CaO | 0.01 | 0.03 | 0.01 | 0.02 | 0.08 | 0.02 | 0.03 | 0.03 | 0.02 | 0.00 | 0.00 | 0.01 | 0.02 |
| Total | 99.95 | 99.38 | 98.95 | 99.94 | 99.60 | 99.61 | 100.07 | 100.06 | 100.29 | 100.02 | 98.71 | 99.88 | 99.41 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.498 | 0.143 | 0.493 | 0.445 | 0.455 | 0.456 | 0.453 | 0.343 | 0.491 | 0.480 | 0.468 | 0.432 | 0.437 |
| Mn | 0.505 | 0.844 | 0.517 | 0.543 | 0.532 | 0.532 | 0.534 | 0.654 | 0.506 | 0.512 | 0.520 | 0.552 | 0.516 |
| Ti | 0.014 | 0.036 | 0.012 | 0.016 | 0.019 | 0.025 | 0.015 | 0.011 | 0.009 | 0.014 | 0.012 | 0.021 | 0.012 |
| Nb | 1.527 | 1.684 | 1.530 | 1.676 | 1.116 | 1.218 | 1.209 | 1.482 | 1.536 | 1.442 | 1.448 | 1.594 | 1.361 |
| Ta | 0.448 | 0.278 | 0.445 | 0.304 | 0.850 | 0.750 | 0.767 | 0.499 | 0.444 | 0.536 | 0.538 | 0.382 | 0.641 |
| Sn | 0.001 | 0.002 | 0.001 | 0.003 | 0.011 | 0.009 | 0.009 | 0.001 | 0.002 | 0.002 | 0.001 | 0.004 | 0.002 |
| W | 0.006 | 0.008 | 0.006 | 0.006 | 0.009 | 0.005 | 0.007 | 0.007 | 0.007 | 0.007 | 0.005 | 0.005 | 0.003 |
| Pb | 0.004 | 0.005 | 0.004 | 0.005 | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.002 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.004 | 0.000 | 0.004 | 0.000 |
| Ca | 0.000 | 0.002 | 0.001 | 0.001 | 0.006 | 0.001 | 0.002 | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 |
| Total | 3.007 | 3.003 | 3.011 | 2.999 | 3.003 | 3.003 | 2.999 | 3.003 | 3.004 | 3.001 | 2.998 | 3.000 | 2.977 |
| Mn/(Mn+Fe) | 0.503 | 0.856 | 0.512 | 0.550 | 0.539 | 0.538 | 0.541 | 0.656 | 0.508 | 0.516 | 0.526 | 0.561 | 0.542 |
| Ta/(Ta+Nb) | 0.227 | 0.142 | 0.225 | 0.154 | 0.432 | 0.381 | 0.388 | 0.252 | 0.224 | 0.271 | 0.271 | 0.193 | 0.320 |
| Comments: | DF - DH | rim | | | | | | DT - DV | | | | inclusions in | |
| | same grain | | | | | | | same grain | | | | cassiterite | |
| | oscillatory zoned | | | | | | | little zoning | | | | | |

| | Big Mack pegmatite | | | | | | | Big Mack peg. | | Big Mack pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 98-83Ci | | | | | | | 98-83Ciii | | 98-83D | | |
| | DA | DB | NK | NL | HD | HJ | HL | BC | BD | CF | CG | CH |
| FeO | 11.75 | 11.29 | 11.90 | 12.17 | 12.31 | 12.20 | 12.74 | 14.12 | 13.34 | 11.45 | 11.51 | 11.14 |
| MnO | 3.04 | 3.19 | 3.11 | 3.52 | 3.65 | 3.62 | 3.34 | 2.59 | 2.47 | 4.53 | 4.71 | 4.61 |
| TiO2 | 0.46 | 0.20 | 0.71 | 0.39 | 0.46 | 0.19 | 0.64 | 3.58 | 3.84 | 0.26 | 0.28 | 0.24 |
| Nb2O5 | 20.84 | 18.94 | 27.27 | 32.31 | 25.56 | 25.93 | 28.30 | 46.92 | 38.13 | 23.06 | 25.27 | 21.60 |
| Ta2O5 | 60.89 | 63.52 | 53.89 | 49.49 | 55.98 | 57.21 | 54.79 | 28.28 | 36.00 | 60.38 | 58.41 | 61.72 |
| SnO2 | 0.87 | 0.86 | 0.68 | 0.37 | 0.21 | 0.08 | 0.09 | 0.95 | 1.07 | 0.13 | 0.09 | 0.33 |
| WO3 | 0.59 | 0.31 | 0.55 | 0.34 | 0.68 | 0.37 | 0.50 | 0.82 | 1.50 | 0.23 | 0.22 | 0.20 |
| PbO | 0.19 | 0.19 | 0.28 | 0.28 | 0.26 | 0.26 | 0.20 | 0.39 | 0.31 | 0.15 | 0.15 | 0.23 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.03 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.08 | 0.04 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.08 | 0.00 | 0.00 | 0.06 | 0.00 | 0.02 | 0.00 | 0.57 | 0.65 | 0.19 | 0.00 | 0.05 |
| CaO | 0.04 | 0.01 | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.22 | 0.02 | 0.01 | 0.00 |
| Total | 98.74 | 98.53 | 98.40 | 98.96 | 99.12 | 99.87 | 100.60 | 98.31 | 97.56 | 100.40 | 100.65 | 100.11 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.742 | 0.726 | 0.727 | 0.722 | 0.755 | 0.745 | 0.759 | 0.754 | 0.745 | 0.705 | 0.699 | 0.694 |
| Mn | 0.195 | 0.207 | 0.192 | 0.211 | 0.227 | 0.224 | 0.201 | 0.140 | 0.140 | 0.282 | 0.290 | 0.291 |
| Ti | 0.026 | 0.012 | 0.039 | 0.021 | 0.026 | 0.010 | 0.034 | 0.172 | 0.193 | 0.014 | 0.015 | 0.014 |
| Nb | 0.712 | 0.658 | 0.900 | 1.036 | 0.848 | 0.856 | 0.912 | 1.355 | 1.152 | 0.767 | 0.830 | 0.728 |
| Ta | 1.251 | 1.328 | 1.070 | 0.954 | 1.117 | 1.136 | 1.062 | 0.491 | 0.654 | 1.209 | 1.154 | 1.251 |
| Sn | 0.026 | 0.026 | 0.020 | 0.010 | 0.006 | 0.002 | 0.003 | 0.024 | 0.028 | 0.004 | 0.002 | 0.010 |
| W | 0.012 | 0.006 | 0.010 | 0.006 | 0.013 | 0.007 | 0.009 | 0.014 | 0.026 | 0.004 | 0.004 | 0.004 |
| Pb | 0.004 | 0.004 | 0.006 | 0.005 | 0.005 | 0.005 | 0.004 | 0.007 | 0.006 | 0.003 | 0.003 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.032 | 0.038 | 0.012 | 0.000 | 0.004 |
| Ca | 0.003 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.016 | 0.002 | 0.001 | 0.000 |
| Total | 2.976 | 2.969 | 2.965 | 2.970 | 2.996 | 2.986 | 2.985 | 2.990 | 2.998 | 3.003 | 2.998 | 2.999 |
| | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.208 | 0.222 | 0.209 | 0.227 | 0.231 | 0.231 | 0.210 | 0.157 | 0.158 | 0.286 | 0.293 | 0.295 |
| Ta/(Ta+Nb) | 0.637 | 0.669 | 0.543 | 0.480 | 0.568 | 0.570 | 0.538 | 0.266 | 0.362 | 0.612 | 0.582 | 0.632 |
| | | | | | | | | | | | | |
| Comments: | patchy zonation | | | | | HJ & HL | | BC & BD same grain | | CF - CH | | |
| | | | | | | same grain | | oscillatory zoning | | same grain | | |
| | | | | | | core | rim | early | late | patchy zonation | | |

| | **Big Mack pegmatite** | | | | | | | | | **Big Mack** | **Sep. Rapids pluton** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 98-83E | | | | | | | | | 98-83G | 98-248 | | |
| | CC | CE | CF | CG | CH | CI | CJ | CK | CL | GD | CA | CB | CC |
| FeO | 12.27 | 12.89 | 13.13 | 11.00 | 13.09 | 11.94 | 11.47 | 10.87 | 13.10 | 12.10 | 15.32 | 15.17 | 12.90 |
| MnO | 4.95 | 5.30 | 5.51 | 5.28 | 5.53 | 5.06 | 4.91 | 4.95 | 6.14 | 3.76 | 4.04 | 4.21 | 3.48 |
| TiO2 | 0.37 | 0.34 | 0.43 | 0.51 | 0.40 | 0.41 | 0.34 | 0.33 | 0.55 | 0.65 | 0.47 | 0.43 | 0.68 |
| Nb2O5 | 39.26 | 48.96 | 54.18 | 28.76 | 52.64 | 35.87 | 29.01 | 29.18 | 58.30 | 29.66 | 60.40 | 61.05 | 28.34 |
| Ta2O5. | 41.14 | 31.35 | 25.52 | 52.81 | 26.67 | 44.94 | 52.35 | 54.24 | 20.19 | 50.70 | 18.51 | 18.22 | 52.58 |
| SnO2 | 0.10 | 0.11 | 0.08 | 0.12 | 0.06 | 0.12 | 0.10 | 0.16 | 0.05 | 1.72 | 0.08 | 0.00 | 0.40 |
| WO3 | 0.46 | 0.47 | 0.51 | 0.30 | 0.41 | 0.42 | 0.35 | 0.22 | 0.42 | 0.22 | 0.76 | 0.45 | 1.00 |
| PbO | 0.32 | 0.40 | 0.46 | 0.29 | 0.54 | 0.36 | 0.36 | 0.25 | 0.38 | 0.08 | 0.24 | 0.23 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.06 | 0.02 | 0.22 | 0.12 | 0.07 | 0.08 | 0.13 | 0.18 | 0.07 | 0.09 | 0.00 | 0.01 | 0.00 |
| CaO | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.30 | 0.00 | 0.02 | 0.01 | 0.00 | 0.03 |
| Total | 98.93 | 99.82 | 100.03 | 99.21 | 99.41 | 99.20 | 99.03 | 100.68 | 99.20 | 98.97 | 99.81 | 99.77 | 99.50 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.700 | 0.695 | 0.688 | 0.662 | 0.695 | 0.692 | 0.691 | 0.645 | 0.677 | 0.723 | 0.780 | 0.771 | 0.773 |
| Mn | 0.286 | 0.289 | 0.292 | 0.321 | 0.298 | 0.297 | 0.300 | 0.298 | 0.321 | 0.228 | 0.208 | 0.217 | 0.211 |
| Ti | 0.019 | 0.016 | 0.020 | 0.027 | 0.019 | 0.021 | 0.018 | 0.017 | 0.026 | 0.035 | 0.022 | 0.020 | 0.037 |
| Nb | 1.211 | 1.428 | 1.535 | 0.935 | 1.512 | 1.123 | 0.945 | 0.936 | 1.628 | 0.958 | 1.663 | 1.678 | 0.919 |
| Ta | 0.763 | 0.550 | 0.435 | 1.033 | 0.461 | 0.847 | 1.026 | 1.047 | 0.339 | 0.985 | 0.307 | 0.301 | 1.025 |
| Sn | 0.003 | 0.003 | 0.002 | 0.004 | 0.002 | 0.003 | 0.003 | 0.005 | 0.001 | 0.049 | 0.002 | 0.000 | 0.012 |
| W | 0.008 | 0.008 | 0.008 | 0.006 | 0.007 | 0.008 | 0.007 | 0.004 | 0.007 | 0.004 | 0.012 | 0.007 | 0.019 |
| Pb | 0.006 | 0.007 | 0.008 | 0.006 | 0.009 | 0.007 | 0.007 | 0.005 | 0.006 | 0.001 | 0.004 | 0.004 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.003 | 0.001 | 0.012 | 0.007 | 0.004 | 0.005 | 0.008 | 0.011 | 0.003 | 0.005 | 0.000 | 0.000 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.023 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 |
| Total | 2.999 | 2.998 | 3.000 | 3.002 | 3.006 | 3.003 | 3.005 | 2.990 | 3.008 | 2.990 | 2.998 | 2.998 | 2.999 |
| Mn/(Mn+Fe) | 0.290 | 0.294 | 0.298 | 0.327 | 0.300 | 0.300 | 0.302 | 0.316 | 0.322 | 0.239 | 0.211 | 0.219 | 0.215 |
| Ta/(Ta+Nb) | 0.387 | 0.278 | 0.221 | 0.525 | 0.234 | 0.430 | 0.521 | 0.528 | 0.172 | 0.507 | 0.156 | 0.152 | 0.527 |
| Comments: | | CC - CH<br>same grain<br>patchy zonation | | | | | CI - CL<br>same grain | | | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Sep. Rapids pluton** | | | | | | **Big Whopper pegmatite** | | | | |
| | | | 98-248 | | | | | | 98-ATBW1 | | | | |
| | CD | CE | CF | CG | BK | BL | BM | BN | BO | BP | BQ | BR | BS |
| FeO | 16.07 | 17.26 | 13.50 | 15.31 | 4.47 | 4.65 | 4.63 | 4.31 | 4.26 | 4.58 | 4.74 | 4.49 | 4.52 |
| MnO | 3.48 | 2.36 | 3.70 | 3.56 | 13.36 | 13.45 | 13.79 | 14.01 | 13.20 | 13.58 | 13.96 | 13.53 | 13.94 |
| TiO2 | 0.83 | 0.60 | 0.97 | 0.89 | 0.14 | 0.34 | 0.24 | 0.21 | 0.19 | 0.23 | 0.33 | 0.54 | 0.21 |
| Nb2O5 | 61.34 | 61.89 | 40.19 | 56.84 | 47.40 | 50.72 | 53.92 | 53.23 | 45.17 | 51.88 | 58.45 | 50.93 | 54.01 |
| Ta2O5 | 17.71 | 16.39 | 38.30 | 21.74 | 33.95 | 29.15 | 25.52 | 27.13 | 35.89 | 28.47 | 20.68 | 28.51 | 25.09 |
| SnO2 | 0.06 | 0.04 | 0.11 | 0.05 | 0.03 | 0.10 | 0.08 | 0.04 | 0.06 | 0.07 | 0.08 | 0.17 | 0.04 |
| WO3 | 0.74 | 0.62 | 1.14 | 1.01 | 0.26 | 0.68 | 0.58 | 0.47 | 0.10 | 0.40 | 0.37 | 0.87 | 0.49 |
| PbO | 0.36 | 0.31 | 0.29 | 0.33 | 0.22 | 0.27 | 0.22 | 0.24 | 0.23 | 0.31 | 0.30 | 0.24 | 0.24 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.02 | 0.15 | 0.06 | 0.17 | 0.01 | 0.00 | 0.01 | 0.00 | 0.10 | 0.03 | 0.02 | 0.04 | 0.08 |
| CaO | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.02 |
| Total | 100.61 | 99.62 | 98.40 | 99.93 | 99.84 | 99.36 | 99.02 | 99.67 | 99.20 | 99.55 | 98.94 | 99.32 | 98.66 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.808 | 0.873 | 0.765 | 0.789 | 0.243 | 0.249 | 0.245 | 0.228 | 0.235 | 0.244 | 0.245 | 0.240 | 0.240 |
| Mn | 0.177 | 0.121 | 0.212 | 0.186 | 0.736 | 0.730 | 0.739 | 0.751 | 0.739 | 0.733 | 0.732 | 0.732 | 0.749 |
| Ti | 0.037 | 0.027 | 0.049 | 0.041 | 0.007 | 0.016 | 0.012 | 0.010 | 0.009 | 0.011 | 0.016 | 0.026 | 0.010 |
| Nb | 1.668 | 1.692 | 1.231 | 1.584 | 1.394 | 1.470 | 1.542 | 1.522 | 1.349 | 1.494 | 1.637 | 1.471 | 1.548 |
| Ta | 0.290 | 0.269 | 0.706 | 0.364 | 0.601 | 0.508 | 0.439 | 0.467 | 0.645 | 0.493 | 0.348 | 0.495 | 0.433 |
| Sn | 0.002 | 0.001 | 0.003 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.004 | 0.001 |
| W | 0.011 | 0.010 | 0.020 | 0.016 | 0.004 | 0.011 | 0.010 | 0.008 | 0.002 | 0.007 | 0.006 | 0.014 | 0.008 |
| Pb | 0.006 | 0.005 | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.001 | 0.008 | 0.003 | 0.009 | 0.001 | 0.000 | 0.001 | 0.000 | 0.006 | 0.001 | 0.001 | 0.002 | 0.005 |
| Ca | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 |
| Total | 3.001 | 3.006 | 3.000 | 2.998 | 2.991 | 2.992 | 2.994 | 2.990 | 2.991 | 2.992 | 2.993 | 2.990 | 2.999 |
| Mn/(Mn+Fe) | 0.180 | 0.122 | 0.217 | 0.191 | 0.752 | 0.746 | 0.751 | 0.767 | 0.758 | 0.750 | 0.749 | 0.753 | 0.757 |
| Ta/(Ta+Nb) | 0.148 | 0.137 | 0.364 | 0.187 | 0.301 | 0.257 | 0.222 | 0.235 | 0.323 | 0.248 | 0.175 | 0.252 | 0.218 |
| Comments: | | CD - CF same grain | | | | BK - BN same grain | | | | BO - BQ | | incl. in | incl. in |
| | core | | rim | | core | | rim | | core | same | rim | petalite | petalite |
| | | oscillatory zonation | | | | | from Avalon Resources trench | | | grain | | | |

| | **Big Whopper pegmatite** | | | | **Big Whopper pegmatite** | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 98-SS27 | | | | 98-SS29 | | | | | | | | | |
| | HB | HC | HD | HN | DA1 | DA2 | DA3 | DB1 | DB2 | DB3 | DB4 | PC | PD | PE |
| FeO | 0.25 | 0.26 | 0.26 | 0.29 | 10.26 | 6.11 | 10.45 | 9.87 | 0.74 | 2.89 | 11.65 | 10.96 | 5.39 | 7.01 |
| MnO | 15.09 | 15.22 | 15.61 | 15.10 | 6.28 | 10.60 | 6.13 | 6.44 | 14.87 | 13.10 | 4.58 | 5.44 | 10.27 | 8.82 |
| TiO2 | 0.15 | 0.17 | 0.20 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.02 | 0.04 | 0.04 | 0.09 | 0.25 | 0.21 |
| Nb2O5 | 21.67 | 22.29 | 26.70 | 20.36 | 34.56 | 35.43 | 35.14 | 29.03 | 26.82 | 27.66 | 29.58 | 28.69 | 23.03 | 24.33 |
| Ta2O5 | 60.75 | 59.41 | 54.56 | 63.09 | 48.07 | 47.05 | 47.06 | 53.60 | 56.42 | 55.65 | 53.16 | 54.25 | 60.00 | 58.73 |
| SnO2 | 0.76 | 0.75 | 1.14 | 0.11 | 0.03 | 0.04 | 0.03 | 0.02 | 0.09 | 0.12 | 0.02 | 0.13 | 0.19 | 0.17 |
| WO3 | 0.23 | 0.33 | 0.57 | 0.21 | 0.10 | 0.16 | 0.15 | 0.20 | 0.24 | 0.26 | 0.17 | 0.15 | 0.32 | 0.32 |
| PbO | 0.26 | 0.41 | 0.27 | 0.29 | 0.16 | 0.17 | 0.15 | 0.17 | 0.12 | 0.12 | 0.09 | 0.25 | 0.23 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.14 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.03 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.06 | 0.00 |
| Sc2O3 | | | | | 0.00 | 0.11 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.08 | 0.00 |
| CaO | 0.02 | 0.03 | 0.00 | 0.01 | 0.03 | 0.05 | 0.01 | 0.02 | 0.05 | 0.05 | 0.02 | 0.01 | 0.02 | 0.01 |
| Total | 99.32 | 98.98 | 99.31 | 99.45 | 99.52 | 99.74 | 99.21 | 99.36 | 99.43 | 99.91 | 99.31 | 100.02 | 99.84 | 99.80 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.016 | 0.016 | 0.016 | 0.018 | 0.600 | 0.354 | 0.610 | 0.595 | 0.045 | 0.174 | 0.700 | 0.658 | 0.334 | 0.431 |
| Mn | 0.950 | 0.967 | 0.963 | 0.968 | 0.372 | 0.622 | 0.362 | 0.393 | 0.918 | 0.801 | 0.279 | 0.331 | 0.644 | 0.550 |
| Ti | 0.008 | 0.010 | 0.011 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.005 | 0.014 | 0.012 |
| Nb | 0.735 | 0.756 | 0.879 | 0.697 | 1.092 | 1.110 | 1.109 | 0.946 | 0.884 | 0.903 | 0.962 | 0.931 | 0.771 | 0.809 |
| Ta | 1.240 | 1.212 | 1.080 | 1.298 | 0.914 | 0.887 | 0.893 | 1.051 | 1.119 | 1.093 | 1.039 | 1.059 | 1.209 | 1.175 |
| Sn | 0.023 | 0.022 | 0.033 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.001 | 0.004 | 0.006 | 0.005 |
| W | 0.004 | 0.006 | 0.011 | 0.004 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.003 | 0.003 | 0.006 | 0.006 |
| Pb | 0.005 | 0.008 | 0.005 | 0.006 | 0.003 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.005 | 0.005 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.005 | 0.000 |
| Ca | 0.001 | 0.003 | 0.000 | 0.001 | 0.003 | 0.004 | 0.001 | 0.002 | 0.004 | 0.004 | 0.002 | 0.001 | 0.002 | 0.001 |
| Total | 2.995 | 3.002 | 2.997 | 2.996 | 2.986 | 2.993 | 2.988 | 2.995 | 2.983 | 2.990 | 2.990 | 2.999 | 2.996 | 2.994 |
| Mn/(Mn+Fe) | 0.984 | 0.983 | 0.984 | 0.981 | 0.383 | 0.637 | 0.373 | 0.398 | 0.953 | 0.821 | 0.285 | 0.334 | 0.658 | 0.560 |
| Ta/(Ta+Nb) | 0.628 | 0.616 | 0.551 | 0.651 | 0.456 | 0.444 | 0.446 | 0.526 | 0.559 | 0.548 | 0.519 | 0.532 | 0.611 | 0.592 |
| Comments: | | HB - HD same grain | | | | traverse 225 µm grain | | | traverse across 200 µm grain | | | | PC - PE same grain | |
| | | lepidolite mass - borehole 98-38 | | | rim | | rim | rim | | | rim | | PC patchy alteration | |
| | | | | | | aplite assoc. with greenstone | | | | | DB traverse - strong oscillatory zonation | | | |

**SW Beryl pegmatite**

99-AT6081

| | NA | XA | XB | XC | XD1 | XD2 | XD3 | XD4 | XD5 | XD6 | XD7 | XE | XF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 15.14 | 16.04 | 16.33 | 16.54 | 15.50 | 15.53 | 15.12 | 16.09 | 15.93 | 15.81 | 16.16 | 14.66 | 16.09 |
| MnO | 2.48 | 2.75 | 2.83 | 2.87 | 2.56 | 2.82 | 2.70 | 2.88 | 2.78 | 2.79 | 2.90 | 2.52 | 2.42 |
| TiO2 | 0.80 | 0.54 | 0.64 | 0.51 | 1.64 | 0.53 | 0.60 | 0.70 | 0.68 | 0.64 | 0.68 | 0.91 | 0.96 |
| Nb2O5 | 42.24 | 56.55 | 56.25 | 58.56 | 49.52 | 52.20 | 46.47 | 57.53 | 56.40 | 56.58 | 58.87 | 38.58 | 52.20 |
| Ta2O5 | 37.79 | 22.81 | 21.55 | 19.07 | 27.72 | 26.56 | 32.94 | 20.71 | 22.13 | 21.99 | 18.96 | 41.65 | 26.35 |
| SnO2 | 0.40 | 0.16 | 0.16 | 0.17 | 0.39 | 0.21 | 0.20 | 0.12 | 0.15 | 0.21 | 0.20 | 0.19 | 0.28 |
| WO3 | 0.26 | 0.52 | 0.46 | 0.63 | 0.54 | 0.50 | 0.53 | 0.46 | 0.47 | 0.48 | 0.64 | 0.34 | 0.47 |
| PbO | 0.18 | 0.23 | 0.21 | 0.23 | 0.23 | 0.22 | 0.18 | 0.24 | 0.24 | 0.21 | 0.22 | 0.13 | 0.22 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.07 | 0.09 | 0.09 | 0.26 | 0.05 | 0.05 | 0.12 | 0.12 | 0.00 | 0.04 | 0.10 | 0.06 |
| CaO | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.32 | 99.68 | 98.53 | 98.67 | 98.37 | 98.63 | 98.79 | 98.85 | 98.90 | 98.71 | 98.66 | 99.06 | 99.04 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.844 | 0.833 | 0.854 | 0.856 | 0.831 | 0.830 | 0.829 | 0.835 | 0.831 | 0.826 | 0.835 | 0.833 | 0.854 |
| Mn | 0.140 | 0.145 | 0.150 | 0.150 | 0.139 | 0.153 | 0.150 | 0.151 | 0.147 | 0.148 | 0.151 | 0.145 | 0.130 |
| Ti | 0.040 | 0.025 | 0.030 | 0.024 | 0.079 | 0.026 | 0.030 | 0.032 | 0.032 | 0.030 | 0.031 | 0.047 | 0.046 |
| Nb | 1.273 | 1.587 | 1.591 | 1.638 | 1.436 | 1.508 | 1.379 | 1.613 | 1.590 | 1.598 | 1.643 | 1.186 | 1.497 |
| Ta | 0.685 | 0.385 | 0.367 | 0.321 | 0.483 | 0.461 | 0.588 | 0.349 | 0.375 | 0.374 | 0.318 | 0.770 | 0.455 |
| Sn | 0.011 | 0.004 | 0.004 | 0.004 | 0.010 | 0.005 | 0.005 | 0.003 | 0.004 | 0.005 | 0.005 | 0.005 | 0.007 |
| W | 0.004 | 0.008 | 0.007 | 0.010 | 0.009 | 0.008 | 0.009 | 0.007 | 0.008 | 0.008 | 0.010 | 0.006 | 0.008 |
| Pb | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 | 0.004 | 0.003 | 0.004 | 0.004 | 0.004 | 0.004 | 0.002 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.004 | 0.005 | 0.005 | 0.014 | 0.003 | 0.003 | 0.007 | 0.006 | 0.000 | 0.002 | 0.006 | 0.003 |
| Ca | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 3.003 | 2.994 | 3.012 | 3.012 | 3.007 | 2.997 | 2.996 | 3.002 | 2.997 | 2.992 | 3.000 | 3.000 | 3.003 |
| | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.142 | 0.148 | 0.149 | 0.149 | 0.143 | 0.156 | 0.153 | 0.154 | 0.150 | 0.152 | 0.154 | 0.148 | 0.132 |
| Ta/(Ta+Nb) | 0.350 | 0.195 | 0.187 | 0.164 | 0.252 | 0.234 | 0.299 | 0.178 | 0.191 | 0.189 | 0.162 | 0.394 | 0.233 |
| | | | | | | | | | | | | | |
| Comments: | | | XA - XC | | | XD1 - XE same grain with distinct oscillatory zonation | | | | | | | |
| | | | same grain | | rim | | | | | | core | | |
| | | | | | all data from inclusions in cassiterite | | | | | | | | |

**Big Mack pegmatite**

99-FWB74

| | LA | LB | LC | LE | LF | LG | LH | LI | LJ | LK | LL | LM | LN | LO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 12.89 | 12.78 | 12.76 | 12.25 | 12.27 | 12.50 | 12.72 | 13.11 | 13.88 | 13.87 | 12.99 | 12.33 | 12.02 | 12.35 |
| MnO | 3.42 | 3.52 | 3.58 | 3.90 | 3.86 | 3.59 | 3.56 | 3.50 | 3.68 | 3.78 | 3.35 | 3.81 | 3.86 | 3.79 |
| TiO2 | 0.38 | 0.49 | 0.43 | 0.55 | 0.59 | 0.57 | 0.43 | 0.42 | 0.27 | 0.30 | 0.65 | 0.66 | 0.58 | 0.63 |
| Nb2O5 | 25.78 | 26.18 | 26.07 | 24.19 | 24.11 | 23.84 | 25.60 | 29.32 | 39.21 | 37.72 | 24.86 | 24.74 | 24.08 | 24.76 |
| Ta2O5 | 56.93 | 56.14 | 56.91 | 58.09 | 57.78 | 58.16 | 56.67 | 53.58 | 41.29 | 42.91 | 57.51 | 57.81 | 58.49 | 57.59 |
| SnO2 | 0.14 | 0.17 | 0.08 | 0.46 | 0.70 | 0.64 | 0.07 | 0.14 | 0.11 | 0.03 | 0.18 | 0.16 | 0.18 | 0.26 |
| WO3 | 0.39 | 0.49 | 0.44 | 0.71 | 0.69 | 0.75 | 0.42 | 0.45 | 0.36 | 0.37 | 0.71 | 0.79 | 0.70 | 0.76 |
| PbO | 0.15 | 0.15 | 0.16 | 0.11 | 0.06 | 0.06 | 0.17 | 0.10 | 0.11 | 0.15 | 0.13 | 0.13 | 0.08 | 0.09 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.02 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Bi2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 |
| Sc2O3 | 0.09 | 0.03 | 0.00 | 0.07 | 0.04 | 0.00 | 0.10 | 0.10 | 0.10 | 0.00 | 0.10 | 0.04 | 0.03 | 0.00 |
| CaO | 0.00 | 0.01 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 |
| Total | 100.20 | 99.97 | 100.42 | 100.38 | 100.11 | 100.12 | 99.74 | 100.76 | 99.05 | 99.14 | 100.48 | 100.46 | 100.05 | 100.29 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.782 | 0.775 | 0.772 | 0.747 | 0.750 | 0.765 | 0.775 | 0.776 | 0.791 | 0.796 | 0.788 | 0.749 | 0.736 | 0.751 |
| Mn | 0.210 | 0.216 | 0.219 | 0.241 | 0.239 | 0.223 | 0.220 | 0.210 | 0.212 | 0.220 | 0.206 | 0.234 | 0.239 | 0.233 |
| Ti | 0.021 | 0.027 | 0.024 | 0.030 | 0.032 | 0.031 | 0.024 | 0.022 | 0.014 | 0.016 | 0.035 | 0.036 | 0.032 | 0.035 |
| Nb | 0.846 | 0.858 | 0.853 | 0.797 | 0.796 | 0.789 | 0.844 | 0.938 | 1.208 | 1.170 | 0.815 | 0.812 | 0.797 | 0.814 |
| Ta | 1.124 | 1.107 | 1.119 | 1.152 | 1.148 | 1.158 | 1.123 | 1.031 | 0.765 | 0.801 | 1.134 | 1.142 | 1.164 | 1.139 |
| Sn | 0.004 | 0.005 | 0.002 | 0.013 | 0.020 | 0.019 | 0.002 | 0.004 | 0.003 | 0.001 | 0.005 | 0.005 | 0.005 | 0.007 |
| W | 0.007 | 0.009 | 0.008 | 0.013 | 0.013 | 0.014 | 0.008 | 0.008 | 0.006 | 0.007 | 0.013 | 0.015 | 0.013 | 0.014 |
| Pb | 0.003 | 0.003 | 0.003 | 0.002 | 0.001 | 0.001 | 0.003 | 0.002 | 0.002 | 0.003 | 0.003 | 0.003 | 0.001 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.006 | 0.002 | 0.000 | 0.005 | 0.002 | 0.000 | 0.006 | 0.006 | 0.006 | 0.000 | 0.006 | 0.002 | 0.002 | 0.000 |
| Ca | 0.000 | 0.001 | 0.000 | 0.003 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.001 |
| Total | 3.003 | 3.002 | 3.000 | 3.003 | 3.004 | 3.001 | 3.005 | 3.000 | 3.008 | 3.013 | 3.006 | 2.998 | 2.993 | 2.998 |
| Mn/(Mn+Fe) | 0.212 | 0.218 | 0.221 | 0.244 | 0.242 | 0.225 | 0.221 | 0.213 | 0.212 | 0.216 | 0.207 | 0.238 | 0.245 | 0.237 |
| Ta/(Ta+Nb) | 0.571 | 0.563 | 0.568 | 0.591 | 0.590 | 0.595 | 0.571 | 0.524 | 0.388 | 0.406 | 0.582 | 0.584 | 0.594 | 0.583 |
| Comments: | | LA - LE<br>traverse along grain | | | | LF - LK<br>same grain | | | LJ & LK<br>darker mottled patch<br>at edge of grain | | | LL - LO same grain | | |

| | Glitter pegmatite | | | | Glitter pegmatite | | | | | | Glitter pegmatite | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 99-GZ1 | | | | 99-GZ2 | | | | | | 99-GZ3 | |
| | BA | BB | BC | BD | FA | FB | BA | BB | BC | BD | GF | GG |
| FeO | 16.20 | 16.90 | 15.53 | 14.80 | 16.68 | 16.42 | 16.01 | 14.86 | 15.27 | 15.49 | 16.53 | 16.46 |
| MnO | 2.43 | 2.29 | 2.03 | 2.20 | 2.48 | 2.67 | 2.48 | 2.78 | 2.41 | 2.37 | 1.93 | 2.06 |
| TiO2 | 1.82 | 2.22 | 3.11 | 3.06 | 2.89 | 2.92 | 2.48 | 1.69 | 1.81 | 1.73 | 3.05 | 2.33 |
| Nb2O5 | 55.66 | 57.91 | 44.63 | 42.46 | 58.27 | 58.89 | 52.89 | 44.60 | 43.76 | 44.59 | 49.07 | 49.44 |
| Ta2O5 | 21.43 | 18.42 | 31.20 | 33.09 | 16.55 | 16.38 | 22.59 | 33.48 | 33.88 | 32.99 | 26.39 | 27.46 |
| SnO2 | 0.33 | 0.44 | 0.62 | 0.90 | 0.69 | 0.62 | 0.53 | 0.28 | 0.35 | 0.26 | 0.48 | 0.24 |
| WO3 | 1.17 | 1.41 | 1.23 | 1.04 | 0.74 | 0.79 | 0.75 | 0.92 | 1.04 | 1.05 | 1.91 | 2.10 |
| PbO | 0.35 | 0.25 | 0.15 | 0.22 | 0.27 | 0.21 | 0.24 | 0.18 | 0.23 | 0.17 | 0.24 | 0.26 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.03 | 0.01 | 0.01 | 0.03 | 0.00 | 0.00 | 0.03 | 0.00 | 0.06 | 0.02 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.20 | 0.15 | 0.44 | 0.43 | 0.45 | 0.42 | 0.41 | 0.23 | 0.24 | 0.34 | 0.54 | 0.48 |
| CaO | 0.12 | 0.03 | 0.05 | 0.17 | 0.01 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 |
| Total | 99.70 | 100.02 | 99.03 | 98.40 | 99.03 | 99.32 | 98.38 | 99.01 | 99.02 | 98.99 | 100.19 | 100.85 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.834 | 0.856 | 0.836 | 0.810 | 0.843 | 0.826 | 0.837 | 0.813 | 0.837 | 0.846 | 0.863 | 0.859 |
| Mn | 0.127 | 0.117 | 0.111 | 0.122 | 0.127 | 0.136 | 0.131 | 0.154 | 0.134 | 0.131 | 0.102 | 0.109 |
| Ti | 0.084 | 0.101 | 0.151 | 0.151 | 0.131 | 0.132 | 0.116 | 0.083 | 0.089 | 0.085 | 0.143 | 0.110 |
| Nb | 1.549 | 1.585 | 1.299 | 1.256 | 1.592 | 1.601 | 1.495 | 1.318 | 1.297 | 1.316 | 1.385 | 1.396 |
| Ta | 0.359 | 0.303 | 0.546 | 0.589 | 0.272 | 0.268 | 0.384 | 0.595 | 0.604 | 0.586 | 0.448 | 0.466 |
| Sn | 0.008 | 0.011 | 0.016 | 0.023 | 0.017 | 0.015 | 0.013 | 0.007 | 0.009 | 0.007 | 0.012 | 0.006 |
| W | 0.019 | 0.022 | 0.021 | 0.018 | 0.012 | 0.012 | 0.012 | 0.016 | 0.018 | 0.018 | 0.031 | 0.034 |
| Pb | 0.006 | 0.004 | 0.003 | 0.004 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 | 0.004 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.011 | 0.008 | 0.025 | 0.025 | 0.024 | 0.022 | 0.022 | 0.013 | 0.014 | 0.020 | 0.029 | 0.026 |
| Ca | 0.008 | 0.002 | 0.004 | 0.012 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Total | 3.004 | 3.008 | 3.011 | 3.010 | 3.022 | 3.015 | 3.016 | 3.002 | 3.007 | 3.010 | 3.018 | 3.011 |
| Mn/(Mn+Fe) | 0.132 | 0.121 | 0.117 | 0.131 | 0.131 | 0.141 | 0.135 | 0.159 | 0.138 | 0.134 | 0.106 | 0.112 |
| Ta/(Ta+Nb) | 0.188 | 0.161 | 0.296 | 0.319 | 0.146 | 0.143 | 0.204 | 0.311 | 0.318 | 0.308 | 0.244 | 0.250 |
| Comments: | BA & BB<br>same grain<br>rim | | BC & BD<br>same grain | | FA & FB<br>same grain | | | BA - BD<br>same grain<br>BA darker core | | | GF & GG<br>same grain<br>inclusion in mica | |

| | Glitter pegmatite<br>99-GZ4 | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DC | DD | DE | DF | DI | DJ | DK | DL | DM | DN | DP | DR | DS | DT |
| FeO | 13.97 | 12.85 | 15.16 | 12.87 | 14.89 | 15.43 | 13.54 | 15.24 | 13.58 | 13.66 | 13.94 | 13.67 | 13.86 | 14.64 |
| MnO | 3.17 | 2.95 | 3.67 | 3.44 | 3.57 | 3.48 | 3.20 | 3.52 | 3.33 | 3.41 | 3.27 | 3.28 | 3.34 | 3.63 |
| TiO2 | 0.69 | 0.61 | 0.75 | 0.54 | 0.51 | 1.22 | 0.43 | 0.78 | 0.62 | 0.90 | 1.15 | 0.54 | 0.73 | 0.61 |
| Nb2O5 | 37.55 | 25.83 | 52.98 | 29.89 | 51.01 | 52.42 | 31.55 | 54.98 | 34.26 | 38.02 | 38.81 | 34.77 | 38.93 | 47.31 |
| Ta2O5 | 43.26 | 55.21 | 25.82 | 51.86 | 28.17 | 26.20 | 49.75 | 23.43 | 46.36 | 41.78 | 40.80 | 45.91 | 41.70 | 33.39 |
| SnO2 | 0.22 | 1.22 | 0.22 | 0.46 | 0.14 | 0.23 | 0.24 | 0.25 | 0.26 | 0.56 | 0.53 | 0.25 | 0.17 | 0.18 |
| WO3 | 0.63 | 0.54 | 0.85 | 0.60 | 0.62 | 1.00 | 0.69 | 0.14 | 0.68 | 0.62 | 0.43 | 0.65 | 0.49 | 0.35 |
| PbO | 0.15 | 0.10 | 0.18 | 0.17 | 0.25 | 0.19 | 0.13 | 0.26 | 0.12 | 0.18 | 0.22 | 0.14 | 0.14 | 0.20 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.08 | 0.08 | 0.05 | 0.06 | 0.05 | 0.00 | 0.17 | 0.03 | 0.01 |
| CaO | 0.00 | 0.01 | 0.00 | 0.16 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.02 | 0.00 |
| Total | 99.64 | 99.32 | 99.64 | 99.99 | 99.21 | 100.26 | 99.61 | 98.65 | 99.29 | 99.21 | 99.19 | 99.39 | 99.42 | 100.33 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.797 | 0.783 | 0.799 | 0.763 | 0.797 | 0.808 | 0.799 | 0.802 | 0.790 | 0.778 | 0.790 | 0.793 | 0.786 | 0.791 |
| Mn | 0.183 | 0.182 | 0.196 | 0.206 | 0.193 | 0.184 | 0.192 | 0.187 | 0.196 | 0.197 | 0.188 | 0.192 | 0.192 | 0.198 |
| Ti | 0.035 | 0.034 | 0.035 | 0.029 | 0.024 | 0.057 | 0.023 | 0.037 | 0.032 | 0.046 | 0.059 | 0.028 | 0.037 | 0.029 |
| Nb | 1.158 | 0.851 | 1.509 | 0.959 | 1.475 | 1.483 | 1.006 | 1.563 | 1.078 | 1.170 | 1.188 | 1.090 | 1.193 | 1.381 |
| Ta | 0.802 | 1.094 | 0.442 | 1.001 | 0.490 | 0.446 | 0.955 | 0.401 | 0.878 | 0.774 | 0.751 | 0.866 | 0.769 | 0.587 |
| Sn | 0.006 | 0.035 | 0.006 | 0.013 | 0.004 | 0.006 | 0.007 | 0.006 | 0.007 | 0.015 | 0.014 | 0.007 | 0.005 | 0.005 |
| W | 0.011 | 0.010 | 0.014 | 0.011 | 0.010 | 0.016 | 0.013 | 0.002 | 0.012 | 0.011 | 0.007 | 0.012 | 0.009 | 0.006 |
| Pb | 0.003 | 0.002 | 0.003 | 0.003 | 0.004 | 0.003 | 0.002 | 0.004 | 0.002 | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 | 0.005 | 0.003 | 0.003 | 0.003 | 0.000 | 0.010 | 0.002 | 0.001 |
| Ca | 0.000 | 0.001 | 0.000 | 0.012 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 |
| Total | 2.996 | 2.993 | 3.004 | 2.997 | 3.002 | 3.009 | 3.001 | 3.005 | 3.001 | 2.999 | 3.002 | 3.002 | 2.996 | 3.002 |
| Mn/(Mn+Fe) | 0.187 | 0.188 | 0.197 | 0.213 | 0.195 | 0.186 | 0.193 | 0.189 | 0.199 | 0.202 | 0.192 | 0.195 | 0.196 | 0.201 |
| Ta/(Ta+Nb) | 0.409 | 0.563 | 0.227 | 0.511 | 0.249 | 0.231 | 0.487 | 0.204 | 0.449 | 0.398 | 0.387 | 0.443 | 0.392 | 0.298 |
| Comments: | DA - DB2 all inclusions in or | | | | | DI - DM | | | | | | patchy | DS & DT | |
| | attached to a single large | | | | | same grain | | | | | | zoned | same grain | |
| | grain of cassiterite | | | | | DI & DL early | | | | | | attached to cassiterite | core | rim |

**Glitter pegmatite**

99-GZ4

| | DU | DV | DW | DX | DY | DA2 | DB2 | EE | EN | ER | ES | EZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.50 | 13.76 | 14.69 | 14.03 | 13.58 | 13.47 | 14.16 | 14.66 | 14.02 | 12.19 | 13.67 | 16.41 |
| MnO | 3.42 | 3.21 | 3.48 | 3.23 | 3.20 | 3.24 | 3.35 | 3.64 | 3.55 | 3.50 | 3.07 | 3.91 |
| TiO2 | 0.69 | 0.56 | 1.01 | 0.82 | 0.53 | 1.04 | 1.64 | 0.42 | 0.58 | 0.62 | 1.35 | 1.35 |
| Nb2O5 | 33.11 | 34.38 | 44.35 | 37.00 | 32.97 | 31.23 | 40.92 | 39.11 | 37.99 | 26.49 | 32.95 | 58.91 |
| Ta2O5 | 48.41 | 47.28 | 34.93 | 42.54 | 48.31 | 50.71 | 37.82 | 40.49 | 43.39 | 55.99 | 47.56 | 17.28 |
| SnO2 | 0.41 | 0.49 | 0.32 | 0.21 | 0.24 | 0.34 | 0.66 | 0.15 | 0.20 | 0.60 | 0.63 | 0.24 |
| WO3 | 0.72 | 0.70 | 1.05 | 1.30 | 0.56 | 0.55 | 0.94 | 0.60 | 0.46 | 0.23 | 0.23 | 0.76 |
| PbO | 0.17 | 0.12 | 0.23 | 0.15 | 0.16 | 0.11 | 0.15 | 0.18 | 0.20 | 0.12 | 0.13 | 0.24 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.06 | 0.04 | 0.06 | 0.08 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 | 0.32 | 0.17 | 0.00 |
| CaO | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.16 | 0.00 | 0.01 |
| Total | 100.50 | 100.57 | 100.12 | 99.37 | 99.58 | 100.75 | 99.64 | 99.25 | 100.39 | 100.25 | 99.75 | 99.11 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.783 | 0.793 | 0.803 | 0.802 | 0.796 | 0.785 | 0.786 | 0.833 | 0.794 | 0.734 | 0.793 | 0.838 |
| Mn | 0.201 | 0.187 | 0.193 | 0.187 | 0.190 | 0.191 | 0.188 | 0.209 | 0.203 | 0.213 | 0.180 | 0.202 |
| Ti | 0.036 | 0.029 | 0.049 | 0.042 | 0.028 | 0.055 | 0.082 | 0.022 | 0.029 | 0.033 | 0.070 | 0.062 |
| Nb | 1.037 | 1.071 | 1.310 | 1.143 | 1.044 | 0.983 | 1.228 | 1.201 | 1.163 | 0.862 | 1.032 | 1.626 |
| Ta | 0.912 | 0.886 | 0.621 | 0.791 | 0.920 | 0.960 | 0.683 | 0.748 | 0.799 | 1.096 | 0.896 | 0.287 |
| Sn | 0.011 | 0.014 | 0.008 | 0.006 | 0.007 | 0.009 | 0.017 | 0.004 | 0.005 | 0.017 | 0.017 | 0.006 |
| W | 0.013 | 0.013 | 0.018 | 0.023 | 0.010 | 0.010 | 0.016 | 0.011 | 0.008 | 0.004 | 0.004 | 0.012 |
| Pb | 0.003 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.003 | 0.003 | 0.004 | 0.002 | 0.002 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.003 | 0.003 | 0.005 | 0.000 | 0.003 | 0.001 | 0.000 | 0.000 | 0.020 | 0.010 | 0.000 |
| Ca | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.012 | 0.000 | 0.000 |
| Total | 3.000 | 2.996 | 3.009 | 3.002 | 2.998 | 2.999 | 3.003 | 3.031 | 3.006 | 2.995 | 3.006 | 3.038 |
| Mn/(Mn+Fe) | 0.204 | 0.191 | 0.194 | 0.189 | 0.193 | 0.196 | 0.193 | 0.201 | 0.204 | 0.225 | 0.185 | 0.194 |
| Ta/(Ta+Nb) | 0.468 | 0.453 | 0.321 | 0.409 | 0.468 | 0.494 | 0.357 | 0.384 | 0.407 | 0.560 | 0.465 | 0.150 |
| Comments: | | | | DX & DY<br>same grain<br>core | rim | A2 & B2<br>same grain<br>core | rim | inclusion<br>in garnet | | | | inclusion<br>in garnet |

| | Glitter pegmatite | | | | | Glitter pegmatite | | | | | | | Glitter peg. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 99-GZ5 | | | | | 99-GZ6 | | | | | | | 99-GZ7 |
| | BJ | BK | BL | BR | BT | CA | CH | CI | CJ | CK | CL | CM | MU |
| FeO | 13.89 | 14.10 | 13.61 | 14.44 | 13.77 | 14.13 | 12.98 | 13.26 | 12.49 | 12.57 | 12.20 | 13.66 | 13.84 |
| MnO | 3.25 | 3.31 | 3.44 | 3.74 | 3.28 | 3.59 | 4.13 | 3.99 | 3.76 | 3.86 | 3.57 | 4.14 | 5.54 |
| TiO2 | 0.55 | 0.78 | 0.40 | 1.36 | 0.83 | 2.61 | 0.43 | 0.67 | 0.83 | 0.58 | 0.89 | 0.66 | 1.51 |
| Nb2O5 | 33.12 | 38.11 | 38.24 | 48.18 | 36.03 | 43.21 | 35.27 | 35.90 | 27.07 | 29.42 | 21.66 | 42.28 | 65.85 |
| Ta2O5 | 48.24 | 42.51 | 43.42 | 30.51 | 44.43 | 33.97 | 45.92 | 46.13 | 55.43 | 52.69 | 60.49 | 37.74 | 10.37 |
| SnO2 | 0.65 | 0.19 | 0.41 | 0.46 | 0.54 | 0.77 | 0.07 | 0.13 | 0.31 | 0.19 | 0.72 | 0.18 | 0.15 |
| WO3 | 0.89 | 1.31 | 0.53 | 0.48 | 0.47 | 0.52 | 0.47 | 0.37 | 0.34 | 0.41 | 0.41 | 0.55 | 0.66 |
| PbO | 0.17 | 0.17 | 0.14 | 0.21 | 0.14 | 0.18 | 0.09 | 0.17 | 0.09 | 0.05 | 0.10 | 0.20 | 0.29 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.10 | 0.00 | 0.00 | 0.12 | 0.04 | 0.00 | 0.13 | 0.00 | 0.06 | 0.00 | 0.00 | 0.02 | 0.48 |
| CaO | 0.00 | 0.09 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.09 |
| Total | 100.86 | 100.56 | 100.19 | 99.49 | 99.55 | 98.97 | 99.49 | 100.68 | 100.38 | 99.75 | 100.04 | 99.43 | 99.07 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.803 | 0.795 | 0.772 | 0.775 | 0.791 | 0.772 | 0.751 | 0.757 | 0.748 | 0.749 | 0.755 | 0.762 | 0.683 |
| Mn | 0.190 | 0.189 | 0.198 | 0.203 | 0.191 | 0.199 | 0.242 | 0.230 | 0.228 | 0.233 | 0.224 | 0.234 | 0.277 |
| Ti | 0.028 | 0.039 | 0.021 | 0.066 | 0.043 | 0.128 | 0.023 | 0.034 | 0.044 | 0.031 | 0.049 | 0.033 | 0.067 |
| Nb | 1.035 | 1.161 | 1.173 | 1.399 | 1.119 | 1.277 | 1.104 | 1.108 | 0.877 | 0.948 | 0.724 | 1.274 | 1.758 |
| Ta | 0.907 | 0.779 | 0.801 | 0.533 | 0.830 | 0.604 | 0.864 | 0.856 | 1.080 | 1.021 | 1.217 | 0.684 | 0.167 |
| Sn | 0.018 | 0.005 | 0.011 | 0.012 | 0.015 | 0.020 | 0.002 | 0.004 | 0.009 | 0.005 | 0.021 | 0.005 | 0.004 |
| W | 0.016 | 0.023 | 0.009 | 0.008 | 0.008 | 0.009 | 0.008 | 0.007 | 0.006 | 0.007 | 0.008 | 0.009 | 0.010 |
| Pb | 0.003 | 0.003 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | 0.001 | 0.002 | 0.004 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.000 | 0.000 | 0.007 | 0.003 | 0.000 | 0.008 | 0.000 | 0.004 | 0.000 | 0.000 | 0.001 | 0.025 |
| Ca | 0.000 | 0.006 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.006 |
| Total | 3.006 | 3.000 | 2.988 | 3.006 | 3.002 | 3.013 | 3.003 | 3.001 | 2.998 | 2.995 | 3.001 | 3.006 | 3.005 |
| Mn/(Mn+Fe) | 0.192 | 0.192 | 0.204 | 0.208 | 0.195 | 0.205 | 0.244 | 0.233 | 0.234 | 0.237 | 0.229 | 0.235 | 0.289 |
| Ta/(Ta+Nb) | 0.467 | 0.402 | 0.406 | 0.276 | 0.426 | 0.321 | 0.439 | 0.436 | 0.552 | 0.519 | 0.627 | 0.349 | 0.087 |
| Comments: | BJ & BK | | inclusion | | inclusion | | | CH - CJ | | | CL & CM | | associated |
| | same grain | | in cassiterite | | in cassiterite | | | same grain | | | same grain | | with |
| | accompanied by ferrowodginite inclusions | | | | | | | oscillatory zoned | | | core | rim | microlite |

| | **Wolf pegmatite** | | | | | **Wolf pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 99-WZ1 | | | | | 99-WZ2 | | | | | |
| | GC | GD | GE | GG | GP | JA | JB | JC | JD | JE | JF |
| FeO | 5.00 | 5.88 | 5.75 | 4.51 | 5.11 | 4.16 | 4.23 | 3.71 | 4.20 | 4.99 | 4.71 |
| MnO | 13.49 | 12.75 | 13.02 | 12.07 | 13.59 | 12.63 | 12.80 | 13.55 | 13.69 | 13.40 | 13.53 |
| TiO2 | 0.32 | 0.34 | 0.38 | 0.45 | 0.38 | 0.28 | 0.23 | 0.27 | 0.33 | 0.34 | 0.27 |
| Nb2O5 | 47.14 | 47.77 | 47.18 | 39.60 | 48.02 | 35.27 | 35.28 | 43.62 | 45.17 | 49.78 | 47.45 |
| Ta2O5 | 29.83 | 29.85 | 27.94 | 38.42 | 28.11 | 45.51 | 44.97 | 36.51 | 33.61 | 29.02 | 31.01 |
| SnO2 | 0.13 | 0.10 | 0.15 | 0.18 | 0.08 | 0.08 | 0.08 | 0.12 | 0.07 | 0.04 | 0.02 |
| WO3 | 2.45 | 1.96 | 4.01 | 1.66 | 2.82 | 1.11 | 1.44 | 1.37 | 1.90 | 1.65 | 1.92 |
| PbO | 0.22 | 0.23 | 0.20 | 1.51 | 0.21 | 0.13 | 0.19 | 0.21 | 0.19 | 0.25 | 0.19 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.02 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| Sc2O3 | 0.08 | 0.13 | 0.05 | 0.07 | 0.14 | 0.11 | 0.10 | 0.04 | 0.00 | 0.00 | 0.00 |
| CaO | 0.04 | 0.02 | 0.03 | 0.21 | 0.03 | 0.03 | 0.02 | 0.06 | 0.11 | 0.00 | 0.01 |
| Total | 98.69 | 99.01 | 98.70 | 98.72 | 98.49 | 99.31 | 99.33 | 99.51 | 99.15 | 99.48 | 99.12 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.273 | 0.319 | 0.313 | 0.258 | 0.278 | 0.241 | 0.245 | 0.206 | 0.231 | 0.268 | 0.257 |
| Mn | 0.746 | 0.701 | 0.719 | 0.699 | 0.749 | 0.742 | 0.751 | 0.761 | 0.763 | 0.729 | 0.746 |
| Ti | 0.016 | 0.017 | 0.019 | 0.023 | 0.018 | 0.014 | 0.012 | 0.014 | 0.016 | 0.016 | 0.013 |
| Nb | 1.392 | 1.403 | 1.389 | 1.224 | 1.412 | 1.105 | 1.106 | 1.308 | 1.343 | 1.446 | 1.398 |
| Ta | 0.530 | 0.527 | 0.495 | 0.715 | 0.497 | 0.858 | 0.848 | 0.659 | 0.601 | 0.507 | 0.549 |
| Sn | 0.003 | 0.003 | 0.004 | 0.005 | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 | 0.000 |
| W | 0.042 | 0.033 | 0.068 | 0.029 | 0.048 | 0.020 | 0.026 | 0.023 | 0.032 | 0.027 | 0.032 |
| Pb | 0.004 | 0.004 | 0.003 | 0.028 | 0.004 | 0.002 | 0.004 | 0.004 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.007 | 0.003 | 0.004 | 0.008 | 0.007 | 0.006 | 0.002 | 0.000 | 0.000 | 0.000 |
| Ca | 0.003 | 0.001 | 0.002 | 0.015 | 0.002 | 0.002 | 0.002 | 0.004 | 0.008 | 0.000 | 0.001 |
| Total | 3.013 | 3.016 | 3.014 | 3.002 | 3.017 | 2.995 | 3.001 | 2.985 | 3.000 | 2.999 | 3.001 |
| Mn/(Mn+Fe) | 0.732 | 0.687 | 0.696 | 0.731 | 0.729 | 0.755 | 0.754 | 0.787 | 0.767 | 0.731 | 0.744 |
| Ta/(Ta+Nb) | 0.276 | 0.273 | 0.263 | 0.369 | 0.260 | 0.437 | 0.434 | 0.335 | 0.309 | 0.260 | 0.282 |
| Comments: | | GD & GE<br>same grain<br>unzoned | | | | JA & JB<br>same grain<br>oscill. zoned | | JC & JD<br>same grain<br>weak oscillatory zonation | | JE & JF<br>same grain | |

| | Wolf pegmatite | | | | Wolf pegmatite | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 99-WZ3 | | | | 99-WZ4 | | | | | | | |
| | FI | FJ | FK | FL | DA | DD | DE | DF | DI | DJ | DK | DL |
| FeO | 5.27 | 5.13 | 5.17 | 4.88 | 5.95 | 4.46 | 5.23 | 4.71 | 4.02 | 6.55 | 3.84 | 5.29 |
| MnO | 13.09 | 12.77 | 13.02 | 13.47 | 12.47 | 13.95 | 13.03 | 13.62 | 14.42 | 12.17 | 14.81 | 13.10 |
| TiO2 | 0.41 | 0.45 | 0.28 | 0.24 | 0.34 | 0.25 | 0.30 | 0.27 | 0.30 | 0.31 | 0.34 | 0.37 |
| Nb2O5 | 47.35 | 43.20 | 46.56 | 46.61 | 47.89 | 46.56 | 47.10 | 48.89 | 50.65 | 47.73 | 50.95 | 48.71 |
| Ta2O5 | 31.13 | 35.19 | 31.39 | 31.49 | 29.45 | 30.25 | 31.27 | 29.49 | 28.26 | 29.52 | 26.97 | 28.95 |
| SnO2 | 0.10 | 0.18 | 0.02 | 0.07 | 0.05 | 0.08 | 0.02 | 0.02 | 0.06 | 0.01 | 0.04 | 0.09 |
| WO3 | 1.82 | 1.69 | 1.79 | 1.85 | 2.47 | 2.73 | 1.77 | 1.29 | 1.12 | 2.60 | 1.63 | 2.08 |
| PbO | 0.23 | 0.15 | 0.14 | 0.17 | 0.22 | 0.18 | 0.10 | 0.16 | 0.21 | 0.22 | 0.23 | 0.17 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.08 | 0.01 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 |
| CaO | 0.00 | 0.00 | 0.03 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.03 | 0.02 | 0.04 | 0.01 |
| Total | 99.39 | 98.75 | 98.48 | 98.79 | 98.86 | 98.54 | 98.86 | 98.53 | 99.08 | 99.10 | 98.85 | 98.77 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | |
| Fe | 0.286 | 0.286 | 0.284 | 0.268 | 0.323 | 0.245 | 0.286 | 0.256 | 0.216 | 0.356 | 0.206 | 0.287 |
| Mn | 0.721 | 0.721 | 0.725 | 0.748 | 0.687 | 0.775 | 0.721 | 0.749 | 0.784 | 0.669 | 0.804 | 0.719 |
| Ti | 0.020 | 0.022 | 0.014 | 0.012 | 0.016 | 0.012 | 0.015 | 0.013 | 0.014 | 0.015 | 0.016 | 0.018 |
| Nb | 1.391 | 1.302 | 1.383 | 1.382 | 1.409 | 1.381 | 1.392 | 1.436 | 1.469 | 1.402 | 1.477 | 1.428 |
| Ta | 0.550 | 0.638 | 0.561 | 0.562 | 0.521 | 0.540 | 0.556 | 0.521 | 0.493 | 0.521 | 0.470 | 0.510 |
| Sn | 0.002 | 0.005 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.002 |
| W | 0.031 | 0.029 | 0.030 | 0.031 | 0.042 | 0.046 | 0.030 | 0.022 | 0.019 | 0.044 | 0.027 | 0.035 |
| Pb | 0.004 | 0.003 | 0.003 | 0.003 | 0.004 | 0.003 | 0.002 | 0.003 | 0.004 | 0.004 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.005 | 0.001 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ca | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.003 | 0.001 |
| Total | 3.005 | 3.005 | 3.006 | 3.008 | 3.004 | 3.010 | 3.003 | 3.005 | 3.003 | 3.012 | 3.008 | 3.003 |
| Mn/(Mn+Fe) | 0.716 | 0.716 | 0.718 | 0.737 | 0.680 | 0.760 | 0.716 | 0.745 | 0.784 | 0.653 | 0.796 | 0.715 |
| Ta/(Ta+Nb) | 0.283 | 0.329 | 0.289 | 0.289 | 0.270 | 0.281 | 0.285 | 0.266 | 0.251 | 0.271 | 0.242 | 0.263 |
| Comments: | FI & FJ<br>same grain | | FK & FL<br>same grain | | | DD & DE<br>same grain<br>unzoned | | | | | | |

**Big Whopper pegmatite**

DC97-6-26

| | DA1 | DA2 | DA3 | DA4 | DA5 | DB | DC | DD | DE | DF |
|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 0.14 | 0.12 | 0.12 | 0.11 | 0.12 | 0.10 | 0.10 | 0.12 | 0.11 | 0.13 |
| MnO | 15.94 | 15.53 | 15.59 | 15.88 | 15.98 | 14.47 | 15.78 | 16.32 | 16.17 | 16.17 |
| TiO2 | 0.08 | 0.13 | 0.12 | 0.11 | 0.10 | 0.43 | 0.19 | 0.16 | 0.15 | 0.20 |
| Nb2O5 | 32.40 | 29.85 | 30.08 | 32.99 | 36.57 | 22.67 | 34.58 | 40.25 | 41.35 | 39.13 |
| Ta2O5 | 49.65 | 52.83 | 52.39 | 48.85 | 45.29 | 58.86 | 47.37 | 40.78 | 40.00 | 42.26 |
| SnO2 | 0.10 | 0.11 | 0.10 | 0.05 | 0.07 | 0.58 | 0.01 | 0.07 | 0.11 | 0.11 |
| WO3 | 0.42 | 0.48 | 0.52 | 0.36 | 0.29 | 0.78 | 0.59 | 0.54 | 0.43 | 0.53 |
| PbO | 0.14 | 0.13 | 0.15 | 0.18 | 0.18 | 0.13 | 0.19 | 0.19 | 0.22 | 0.18 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.03 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.06 | 0.06 | 0.00 | 0.00 | 0.10 | 0.00 | 0.04 | 0.00 |
| CaO | 0.02 | 0.06 | 0.00 | 0.05 | 0.02 | 0.02 | 0.03 | 0.02 | 0.03 | 0.01 |
| Total | 98.92 | 99.23 | 99.12 | 98.62 | 98.62 | 98.03 | 98.93 | 98.43 | 98.60 | 98.72 |
| | | | | | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | |
| Fe | 0.008 | 0.007 | 0.007 | 0.006 | 0.007 | 0.006 | 0.006 | 0.007 | 0.006 | 0.008 |
| Mn | 0.958 | 0.943 | 0.947 | 0.953 | 0.942 | 0.922 | 0.936 | 0.944 | 0.928 | 0.938 |
| Ti | 0.004 | 0.007 | 0.006 | 0.006 | 0.005 | 0.024 | 0.010 | 0.008 | 0.008 | 0.010 |
| Nb | 1.039 | 0.968 | 0.975 | 1.057 | 1.150 | 0.771 | 1.095 | 1.242 | 1.267 | 1.211 |
| Ta | 0.958 | 1.030 | 1.021 | 0.941 | 0.857 | 1.204 | 0.902 | 0.757 | 0.737 | 0.787 |
| Sn | 0.003 | 0.003 | 0.003 | 0.001 | 0.002 | 0.017 | 0.000 | 0.002 | 0.003 | 0.003 |
| W | 0.008 | 0.009 | 0.010 | 0.007 | 0.005 | 0.015 | 0.011 | 0.009 | 0.008 | 0.009 |
| Pb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.004 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.004 | 0.003 | 0.000 | 0.000 | 0.006 | 0.000 | 0.002 | 0.000 |
| Ca | 0.001 | 0.004 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 |
| Total | 2.982 | 2.975 | 2.976 | 2.981 | 2.973 | 2.965 | 2.971 | 2.973 | 2.966 | 2.971 |
| | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.991 | 0.992 | 0.993 | 0.993 | 0.993 | 0.993 | 0.994 | 0.993 | 0.993 | 0.992 |
| Ta/(Ta+Nb) | 0.480 | 0.516 | 0.512 | 0.471 | 0.427 | 0.610 | 0.452 | 0.379 | 0.368 | 0.394 |
| | | | | | | | | | | |
| Comments: | | | unzoned | | | DB - DF same grain | | | | |
| | | | Avalon Resources borehole | | | patchy zoned area | | | | |
| | | | | | | rest of grain - unzoned | | | | |

| | Big Whopper peg. | | | Big Whopper pegmatite | | | | | | Big Whopper pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DC97-8-57 | | | DC97-8-91 | | | | | | DC97-8-124 | | | | | |
| | CA | CB | CC | BB | BC | BD | BF | BG | BI | BL | BM | BN | BO | BP | BQ |
| FeO | 12.43 | 13.03 | 13.86 | 3.81 | 4.22 | 3.95 | 4.03 | 4.16 | 3.49 | 6.42 | 6.61 | 7.77 | 5.75 | 5.34 | 5.35 |
| MnO | 7.16 | 6.90 | 6.21 | 14.44 | 14.02 | 14.18 | 14.96 | 13.73 | 13.61 | 10.77 | 9.35 | 9.42 | 10.35 | 11.66 | 11.81 |
| TiO2 | 0.69 | 0.92 | 0.54 | 0.21 | 0.41 | 0.20 | 0.27 | 0.22 | 0.22 | 0.33 | 0.37 | 0.41 | 0.37 | 0.44 | 0.35 |
| Nb2O5 | 68.37 | 69.38 | 67.81 | 52.63 | 51.71 | 50.67 | 60.24 | 46.51 | 39.55 | 43.43 | 31.70 | 44.09 | 32.12 | 42.84 | 44.75 |
| Ta2O5 | 9.40 | 8.44 | 10.80 | 28.00 | 28.50 | 30.37 | 20.04 | 33.65 | 43.69 | 37.99 | 50.81 | 37.34 | 49.72 | 38.57 | 36.34 |
| SnO2 | 0.06 | 0.03 | 0.02 | 0.04 | 0.14 | 0.03 | 0.11 | 0.05 | 0.25 | 0.06 | 0.16 | 0.12 | 0.14 | 0.09 | 0.14 |
| WO3 | 0.69 | 1.30 | 0.65 | 0.44 | 0.74 | 0.58 | 0.40 | 0.64 | 0.40 | 0.42 | 0.46 | 0.65 | 0.57 | 0.51 | 0.52 |
| PbO | 0.33 | 0.36 | 0.35 | 0.23 | 0.26 | 0.30 | 0.32 | 0.23 | 0.16 | 0.20 | 0.15 | 0.18 | 0.10 | 0.12 | 0.17 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.01 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.10 | 0.26 | 0.12 | 0.00 | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | 0.04 | 0.00 | 0.00 |
| CaO | 0.03 | 0.00 | 0.02 | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 99.24 | 100.62 | 100.36 | 99.83 | 100.06 | 100.30 | 100.38 | 99.24 | 101.40 | 99.64 | 99.66 | 99.99 | 99.16 | 99.57 | 99.41 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.612 | 0.630 | 0.679 | 0.202 | 0.224 | 0.211 | 0.205 | 0.228 | 0.195 | 0.357 | 0.39[illegible] | 0.429 | 0.340 | 0.297 | 0.295 |
| Mn | 0.357 | 0.338 | 0.308 | 0.775 | 0.752 | 0.766 | 0.771 | 0.762 | 0.771 | 0.606 | 0.560 | 0.526 | 0.620 | 0.658 | 0.661 |
| Ti | 0.030 | 0.040 | 0.024 | 0.010 | 0.020 | 0.010 | 0.012 | 0.011 | 0.011 | 0.016 | 0.020 | 0.020 | 0.020 | 0.022 | 0.017 |
| Nb | 1.818 | 1.814 | 1.796 | 1.507 | 1.481 | 1.461 | 1.656 | 1.378 | 1.195 | 1.304 | 1.012 | 1.314 | 1.027 | 1.289 | 1.336 |
| Ta | 0.150 | 0.133 | 0.172 | 0.482 | 0.491 | 0.527 | 0.332 | 0.600 | 0.794 | 0.686 | 0.976 | 0.670 | 0.956 | 0.698 | 0.653 |
| Sn | 0.001 | 0.001 | 0.000 | 0.001 | 0.004 | 0.001 | 0.003 | 0.001 | 0.007 | 0.001 | 0.004 | 0.003 | 0.004 | 0.002 | 0.004 |
| W | 0.011 | 0.020 | 0.010 | 0.007 | 0.012 | 0.010 | 0.006 | 0.011 | 0.007 | 0.007 | 0.008 | 0.011 | 0.010 | 0.009 | 0.009 |
| Pb | 0.005 | 0.006 | 0.005 | 0.004 | 0.004 | 0.005 | 0.005 | 0.004 | 0.003 | 0.004 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.013 | 0.006 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 |
| Ca | 0.002 | 0.000 | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Total | 2.992 | 2.994 | 3.001 | 2.990 | 2.992 | 2.990 | 2.990 | 2.998 | 2.984 | 2.982 | 2.975 | 2.978 | 2.980 | 2.978 | 2.978 |
| Mn/(Mn+Fe) | 0.368 | 0.349 | 0.312 | 0.793 | 0.771 | 0.784 | 0.790 | 0.770 | 0.798 | 0.630 | 0.589 | 0.551 | 0.646 | 0.689 | 0.691 |
| Ta/(Ta+Nb) | 0.076 | 0.068 | 0.087 | 0.242 | 0.249 | 0.265 | 0.167 | 0.303 | 0.399 | 0.345 | 0.491 | 0.338 | 0.482 | 0.351 | 0.328 |
| Comments: | | 3 small grains | | | | BC - BG from cluster of grains | | | | | | BM - BO same grain | | | |
| | | Avalon Resources borehole | | | | Avalon Resources borehole | | | | | mainly unzoned | | rim | | |
| | | | | | | | | | | | | Avalon Resources borehole | | | |

| | SW Beryl pegmatite | | | | SW Beryl pegmatite | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EFR-6056A | | | | EFR-6056B | | | | | | | | | | |
| | EA | EB | EC | ED | KA | KB | KC1 | KC2 | KC3 | KC4 | KC5 | KC6 | KC7 | KC8 | KC9 |
| FeO | 10.89 | 11.26 | 10.85 | 10.99 | 10.28 | 10.51 | 9.46 | 8.61 | 8.63 | 9.04 | 8.13 | 8.21 | 9.12 | 8.72 | 8.44 |
| MnO | 6.46 | 6.92 | 6.48 | 6.66 | 6.56 | 7.21 | 6.49 | 7.29 | 7.17 | 6.76 | 7.42 | 7.48 | 6.59 | 7.19 | 7.41 |
| TiO2 | 0.48 | 0.40 | 0.51 | 0.42 | 0.31 | 0.33 | 0.30 | 0.34 | 0.38 | 0.33 | 0.45 | 0.40 | 0.36 | 0.38 | 0.40 |
| Nb2O5 | 36.40 | 45.68 | 35.26 | 39.64 | 43.89 | 55.09 | 32.87 | 34.75 | 31.23 | 29.13 | 28.61 | 28.45 | 28.57 | 27.77 | 28.56 |
| Ta2O5 | 44.40 | 33.27 | 45.48 | 41.31 | 37.59 | 25.28 | 49.37 | 47.48 | 50.93 | 53.21 | 53.59 | 53.83 | 53.93 | 54.02 | 52.86 |
| SnO2 | 0.13 | 0.13 | 0.18 | 0.11 | 0.08 | 0.04 | 0.06 | 0.07 | 0.10 | 0.25 | 0.16 | 0.39 | 0.10 | 0.60 | 0.65 |
| WO3 | 0.69 | 0.74 | 0.72 | 0.67 | 0.35 | 0.42 | 0.44 | 0.43 | 0.51 | 0.60 | 0.64 | 0.55 | 0.61 | 0.58 | 0.58 |
| PbO | 0.13 | 0.18 | 0.11 | 0.16 | 0.20 | 0.28 | 0.10 | 0.17 | 0.24 | 0.15 | 0.11 | 0.11 | 0.06 | 0.09 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.07 | 0.06 | 0.01 | 0.03 | 0.00 | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.08 |
| CaO | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | 0.05 | 0.02 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 |
| Total | 99.66 | 98.66 | 99.65 | 99.97 | 99.35 | 99.16 | 99.08 | 99.25 | 99.21 | 99.48 | 99.13 | 99.46 | 99.38 | 99.37 | 99.11 |
| | | | | | | | | | | | | | | | |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.625 | 0.621 | 0.626 | 0.619 | 0.572 | 0.553 | 0.558 | 0.503 | 0.513 | 0.543 | 0.490 | 0.494 | 0.549 | 0.527 | 0.508 |
| Mn | 0.376 | 0.387 | 0.379 | 0.380 | 0.370 | 0.384 | 0.388 | 0.431 | 0.432 | 0.411 | 0.453 | 0.456 | 0.402 | 0.440 | 0.452 |
| Ti | 0.025 | 0.020 | 0.027 | 0.021 | 0.015 | 0.016 | 0.016 | 0.018 | 0.020 | 0.018 | 0.024 | 0.022 | 0.020 | 0.021 | 0.022 |
| Nb | 1.130 | 1.362 | 1.100 | 1.208 | 1.319 | 1.568 | 1.049 | 1.096 | 1.004 | 0.945 | 0.933 | 0.926 | 0.930 | 0.907 | 0.931 |
| Ta | 0.829 | 0.597 | 0.854 | 0.757 | 0.680 | 0.433 | 0.948 | 0.901 | 0.985 | 1.039 | 1.051 | 1.054 | 1.056 | 1.061 | 1.036 |
| Sn | 0.004 | 0.003 | 0.005 | 0.003 | 0.002 | 0.001 | 0.002 | 0.002 | 0.003 | 0.007 | 0.004 | 0.011 | 0.003 | 0.017 | 0.019 |
| W | 0.012 | 0.013 | 0.013 | 0.012 | 0.006 | 0.007 | 0.008 | 0.008 | 0.009 | 0.011 | 0.012 | 0.010 | 0.011 | 0.011 | 0.011 |
| Pb | 0.002 | 0.003 | 0.002 | 0.003 | 0.004 | 0.005 | 0.002 | 0.003 | 0.005 | 0.003 | 0.002 | 0.002 | 0.001 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.004 | 0.004 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.005 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.004 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 |
| Total | 3.007 | 3.011 | 3.010 | 3.004 | 2.971 | 2.968 | 2.971 | 2.968 | 2.974 | 2.977 | 2.971 | 2.976 | 2.975 | 2.988 | 2.986 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.375 | 0.384 | 0.377 | 0.380 | 0.393 | 0.410 | 0.410 | 0.462 | 0.457 | 0.431 | 0.480 | 0.480 | 0.422 | 0.455 | 0.471 |
| Ta/(Ta+Nb) | 0.423 | 0.305 | 0.437 | 0.385 | 0.340 | 0.216 | 0.475 | 0.451 | 0.495 | 0.524 | 0.530 | 0.532 | 0.532 | 0.539 | 0.527 |
| | | | | | | | | | | | | | | | |
| Comments: | EA - ED | | | | KA - KC | | | | KC traverse from rim to core to rim | | | | | | |
| | same grain | | | | same grain | | | | of strongly oscillatory zoned grain | | | | | | |
| | ED darker core region | | | | | | | | Emerald Fields Resource Corporation sample | | | | | | |

**SW Beryl pegmatite**

EFR-6056B

| | KC10 | KC11 | KC12 | KC13 | KC14 | KD1 | KD2 | KD4 | KD5 | KD6 | KD7 | KD8 | KD9 | KD10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.32 | 8.32 | 8.30 | 8.73 | 11.18 | 9.39 | 8.80 | 8.67 | 8.96 | 8.18 | 8.21 | 9.25 | 8.67 | 8.34 |
| MnO | 7.39 | 7.50 | 7.46 | 8.19 | 6.88 | 6.52 | 7.25 | 7.15 | 6.86 | 7.47 | 7.55 | 6.48 | 7.19 | 7.43 |
| TiO2 | 0.45 | 0.42 | 0.37 | 0.29 | 0.32 | 0.31 | 0.31 | 0.36 | 0.35 | 0.45 | 0.35 | 0.39 | 0.37 | 0.36 |
| Nb2O5 | 27.43 | 28.46 | 29.80 | 39.30 | 52.47 | 32.52 | 34.73 | 29.67 | 28.73 | 28.49 | 28.22 | 28.80 | 28.00 | 28.80 |
| Ta2O5 | 54.14 | 53.74 | 52.44 | 42.41 | 27.29 | 49.66 | 47.31 | 52.16 | 53.28 | 53.59 | 53.70 | 53.75 | 53.78 | 52.82 |
| SnO2 | 0.62 | 0.14 | 0.27 | 0.07 | 0.06 | 0.05 | 0.06 | 0.19 | 0.29 | 0.18 | 0.38 | 0.10 | 0.58 | 0.63 |
| WO3 | 0.79 | 0.72 | 0.43 | 0.34 | 0.39 | 0.36 | 0.44 | 0.59 | 0.56 | 0.64 | 0.51 | 0.60 | 0.57 | 0.57 |
| PbO | 0.12 | 0.13 | 0.13 | 0.17 | 0.25 | 0.15 | 0.14 | 0.20 | 0.11 | 0.09 | 0.08 | 0.07 | 0.09 | 0.18 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.07 | 0.07 | 0.17 | 0.01 | 0.08 | 0.02 | 0.01 |
| CaO | 0.02 | 0.00 | 0.00 | 0.02 | 0.01 | 0.01 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.02 |
| Total | 99.26 | 99.42 | 99.23 | 99.55 | 98.85 | 98.97 | 99.04 | 99.10 | 99.21 | 99.26 | 99.01 | 99.51 | 99.26 | 99.14 |

**Structural formulae based on 6 oxygens**

| | KC10 | KC11 | KC12 | KC13 | KC14 | KD1 | KD2 | KD4 | KD5 | KD6 | KD7 | KD8 | KD9 | KD10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.504 | 0.501 | 0.497 | 0.496 | 0.597 | 0.556 | 0.514 | 0.520 | 0.540 | 0.492 | 0.497 | 0.555 | 0.524 | 0.502 |
| Mn | 0.453 | 0.457 | 0.453 | 0.471 | 0.372 | 0.391 | 0.429 | 0.435 | 0.418 | 0.456 | 0.463 | 0.394 | 0.440 | 0.453 |
| Ti | 0.024 | 0.023 | 0.020 | 0.015 | 0.016 | 0.016 | 0.016 | 0.019 | 0.019 | 0.024 | 0.019 | 0.021 | 0.020 | 0.019 |
| Nb | 0.898 | 0.926 | 0.965 | 1.207 | 1.5[illegible] | 1.041 | 1.097 | 0.962 | 0.935 | 0.927 | 0.923 | 0.935 | 0.914 | 0.938 |
| Ta | 1.066 | 1.052 | 1.022 | 0.784 | 0.474 | 0.956 | 0.899 | 1.018 | 1.043 | 1.049 | 1.057 | 1.049 | 1.057 | 1.035 |
| Sn | 0.018 | 0.004 | 0.008 | 0.002 | 0.002 | 0.002 | 0.002 | 0.005 | 0.008 | 0.005 | 0.011 | 0.003 | 0.017 | 0.018 |
| W | 0.015 | 0.013 | 0.008 | 0.006 | 0.006 | 0.007 | 0.008 | 0.011 | 0.010 | 0.012 | 0.010 | 0.011 | 0.011 | 0.011 |
| Pb | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.003 | 0.003 | 0.004 | 0.002 | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.004 | 0.011 | 0.000 | 0.005 | 0.001 | 0.000 |
| Ca | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 |
| Total | 2.982 | 2.979 | 2.976 | 2.985 | 2.986 | 2.973 | 2.972 | 2.980 | 2.981 | 2.978 | 2.981 | 2.975 | 2.985 | 2.982 |
| | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.474 | 0.477 | 0.477 | 0.487 | 0.384 | 0.413 | 0.455 | 0.455 | 0.437 | 0.481 | 0.482 | 0.415 | 0.457 | 0.474 |
| Ta/(Ta+Nb) | 0.543 | 0.532 | 0.514 | 0.394 | 0.238 | 0.479 | 0.450 | 0.514 | 0.527 | 0.531 | 0.534 | 0.529 | 0.536 | 0.525 |

Comments: KD & KE same spot

Emerald Fields Resource Corporation sample

**SW Beryl pegmatite**

**EFR-6056B**

| | KD11 | KD12 | KD13 | KD14 | KD15 | KE1 | KE2 | KE3 | KE4 | KE5 | KE6 | KE7 | KE8 | KE9 | KE10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.40 | 8.37 | 8.78 | 8.57 | 11.47 | 9.71 | 8.83 | 8.75 | 8.88 | 8.13 | 8.18 | 9.24 | 8.64 | 8.35 | 8.34 |
| MnO | 7.58 | 7.65 | 8.02 | 7.91 | 6.90 | 6.46 | 7.09 | 7.23 | 6.85 | 7.56 | 7.51 | 6.56 | 7.22 | 7.48 | 7.66 |
| TiO2 | 0.42 | 0.38 | 0.31 | 0.27 | 0.37 | 0.31 | 0.34 | 0.36 | 0.38 | 0.43 | 0.39 | 0.39 | 0.34 | 0.44 | 0.37 |
| Nb2O5 | 28.73 | 29.99 | 39.69 | 37.31 | 52.59 | 32.88 | 31.21 | 30.55 | 28.79 | 28.78 | 28.42 | 28.81 | 28.00 | 28.56 | 29.67 |
| Ta2O5 | 53.60 | 52.50 | 42.28 | 44.60 | 27.09 | 49.80 | 51.03 | 51.90 | 53.29 | 53.68 | 53.54 | 53.39 | 53.62 | 53.43 | 52.22 |
| SnO2 | 0.15 | 0.24 | 0.08 | 0.02 | 0.08 | 0.06 | 0.07 | 0.12 | 0.32 | 0.14 | 0.41 | 0.10 | 0.52 | 0.11 | 0.25 |
| WO3 | 0.80 | 0.49 | 0.41 | 0.41 | 0.42 | 0.34 | 0.49 | 0.53 | 0.56 | 0.54 | 0.53 | 0.52 | 0.51 | 0.77 | 0.48 |
| PbO | 0.05 | 0.12 | 0.15 | 0.21 | 0.27 | 0.17 | 0.14 | 0.12 | 0.14 | 0.09 | 0.13 | 0.18 | 0.14 | 0.15 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.14 | 0.01 | 0.17 | 0.00 | 0.00 | 0.25 | 0.12 | 0.00 | 0.10 | 0.00 | 0.00 | 0.04 | 0.07 | 0.05 | 0.00 |
| CaO | 0.00 | 0.01 | 0.03 | 0.16 | 0.02 | 0.01 | 0.03 | 0.02 | 0.00 | 0.03 | 0.00 | 0.02 | 0.01 | 0.03 | 0.01 |
| Total | 99.86 | 99.75 | 99.89 | 99.29 | 99.20 | 99.98 | 99.33 | 99.57 | 99.29 | 99.39 | 99.09 | 99.24 | 99.06 | 99.34 | 99.08 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.502 | 0.498 | 0.496 | 0.492 | 0.610 | 0.568 | 0.524 | 0.520 | 0.534 | 0.489 | 0.494 | 0.556 | 0.523 | 0.503 | 0.500 |
| Mn | 0.459 | 0.461 | 0.459 | 0.461 | 0.371 | 0.383 | 0.426 | 0.436 | 0.417 | 0.461 | 0.459 | 0.400 | 0.443 | 0.456 | 0.465 |
| Ti | 0.022 | 0.020 | 0.016 | 0.014 | 0.018 | 0.017 | 0.018 | 0.019 | 0.020 | 0.023 | 0.021 | 0.021 | 0.019 | 0.024 | 0.020 |
| Nb | 0.929 | 0.965 | 1.211 | 1.159 | 1.512 | 1.040 | 1.001 | 0.982 | 0.936 | 0.935 | 0.928 | 0.938 | 0.916 | 0.929 | 0.962 |
| Ta | 1.042 | 1.017 | 0.776 | 0.833 | 0.469 | 0.947 | 0.985 | 1.004 | 1.042 | 1.049 | 1.052 | 1.045 | 1.055 | 1.045 | 1.018 |
| Sn | 0.004 | 0.007 | 0.002 | 0.000 | 0.002 | 0.002 | 0.002 | 0.003 | 0.009 | 0.004 | 0.012 | 0.003 | 0.015 | 0.003 | 0.007 |
| W | 0.015 | 0.009 | 0.007 | 0.007 | 0.007 | 0.006 | 0.009 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.010 | 0.014 | 0.009 |
| Pb | 0.001 | 0.002 | 0.003 | 0.004 | 0.005 | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | 0.002 | 0.004 | 0.003 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.009 | 0.001 | 0.010 | 0.000 | 0.000 | 0.015 | 0.008 | 0.000 | 0.007 | 0.000 | 0.000 | 0.003 | 0.004 | 0.003 | 0.000 |
| Ca | 0.000 | 0.001 | 0.002 | 0.012 | 0.001 | 0.001 | 0.002 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.001 | 0.002 | 0.000 |
| Total | 2.983 | 2.982 | 2.982 | 2.982 | 2.995 | 2.981 | 2.979 | 2.978 | 2.979 | 2.976 | 2.978 | 2.981 | 2.988 | 2.982 | 2.984 |
| | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.478 | 0.481 | 0.481 | 0.483 | 0.378 | 0.403 | 0.448 | 0.456 | 0.438 | 0.485 | 0.482 | 0.418 | 0.458 | 0.476 | 0.482 |
| Ta/(Ta+Nb) | 0.529 | 0.513 | 0.391 | 0.418 | 0.237 | 0.477 | 0.496 | 0.505 | 0.527 | 0.529 | 0.531 | 0.527 | 0.535 | 0.529 | 0.514 |

Comments:

Emerald Fields Resource Corporation sample

|  |  |  |  |  |  |  |  | SW Beryl pegmatite |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  |  |  |  | EFR-6056B |  |  |  |  |  |  |  |  |
|  | KF1 | KF2 | KF3 | KF4 | KG | KH1 | KH2 | KH4 | KH5 | KH6 | KH7 | KH8 | KH9 | KH10 | KH11 | KH12 |
| FeO | 9.66 | 8.73 | 8.38 | 8.55 | 7.83 | 8.39 | 7.78 | 7.81 | 7.96 | 7.74 | 7.69 | 8.14 | 8.06 | 8.02 | 8.86 | 8.64 |
| MnO | 6.42 | 7.06 | 7.69 | 8.00 | 7.52 | 7.45 | 7.52 | 7.55 | 7.60 | 7.66 | 8.27 | 7.51 | 7.38 | 7.42 | 7.75 | 7.77 |
| TiO2 | 0.33 | 0.34 | 0.38 | 0.29 | 0.50 | 0.37 | 0.42 | 0.39 | 0.38 | 0.43 | 0.35 | 0.46 | 0.32 | 0.34 | 0.32 | 0.40 |
| Nb2O5 | 32.73 | 30.90 | 29.69 | 38.61 | 25.22 | 30.45 | 23.37 | 23.35 | 23.81 | 23.93 | 30.29 | 25.67 | 24.88 | 24.61 | 36.33 | 33.29 |
| Ta2O5 | 49.35 | 51.21 | 52.00 | 42.78 | 57.24 | 52.90 | 59.48 | 60.15 | 59.41 | 59.26 | 52.24 | 57.07 | 57.81 | 58.86 | 45.24 | 49.05 |
| SnO2 | 0.08 | 0.13 | 0.20 | 0.08 | 0.23 | 0.11 | 0.17 | 0.12 | 0.10 | 0.16 | 0.10 | 0.28 | 0.34 | 0.10 | 0.03 | 0.11 |
| WO3 | 0.37 | 0.54 | 0.50 | 0.45 | 0.63 | 0.42 | 0.57 | 0.54 | 0.61 | 0.55 | 0.60 | 0.69 | 0.68 | 0.62 | 0.45 | 0.50 |
| PbO | 0.10 | 0.12 | 0.15 | 0.17 | 0.07 | 0.16 | 0.09 | 0.05 | 0.06 | 0.12 | 0.13 | 0.07 | 0.05 | 0.12 | 0.14 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.02 | 0.00 | 0.07 | 0.05 | 0.02 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.17 | 0.11 | 0.05 | 0.00 | 0.04 |
| CaO | 0.01 | 0.01 | 0.03 | 0.02 | 0.02 | 0.02 | 0.01 | 0.01 | 0.02 | 0.01 | 0.01 | 0.00 | 0.03 | 0.04 | 0.01 | 0.03 |
| Total | 99.04 | 99.04 | 98.98 | 98.99 | 99.32 | 100.26 | 99.45 | 100.01 | 99.96 | 99.86 | 99.68 | 100.04 | 99.66 | 100.18 | 99.13 | 99.95 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.571 | 0.521 | 0.503 | 0.489 | 0.480 | 0.496 | 0.482 | 0.482 | 0.490 | 0.476 | 0.458 | 0.494 | 0.494 | 0.490 | 0.513 | 0.504 |
| Mn | 0.384 | 0.426 | 0.467 | 0.464 | 0.467 | 0.447 | 0.472 | 0.471 | 0.474 | 0.477 | 0.498 | 0.462 | 0.458 | 0.459 | 0.454 | 0.459 |
| Ti | 0.018 | 0.018 | 0.020 | 0.015 | 0.027 | 0.019 | 0.023 | 0.022 | 0.021 | 0.024 | 0.019 | 0.025 | 0.018 | 0.019 | 0.017 | 0.021 |
| Nb | 1.045 | 0.996 | 0.963 | 1.195 | 0.836 | 0.975 | 0.783 | 0.778 | 0.792 | 0.796 | 0.975 | 0.842 | 0.824 | 0.814 | 1.137 | 1.050 |
| Ta | 0.948 | 0.993 | 1.015 | 0.796 | 1.141 | 1.019 | 1.198 | 1.206 | 1.189 | 1.186 | 1.011 | 1.126 | 1.152 | 1.171 | 0.851 | 0.931 |
| Sn | 0.002 | 0.004 | 0.006 | 0.002 | 0.007 | 0.003 | 0.005 | 0.003 | 0.003 | 0.005 | 0.003 | 0.008 | 0.010 | 0.003 | 0.001 | 0.003 |
| W | 0.007 | 0.010 | 0.009 | 0.008 | 0.012 | 0.008 | 0.011 | 0.010 | 0.012 | 0.011 | 0.011 | 0.013 | 0.013 | 0.012 | 0.008 | 0.009 |
| Pb | 0.002 | 0.002 | 0.003 | 0.003 | 0.001 | 0.003 | 0.002 | 0.001 | 0.001 | 0.002 | 0.003 | 0.001 | 0.001 | 0.002 | 0.003 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.001 | 0.000 | 0.004 | 0.003 | 0.001 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.010 | 0.007 | 0.003 | 0.000 | 0.002 |
| Ca | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.002 | 0.003 | 0.001 | 0.002 |
| Total | 2.977 | 2.973 | 2.988 | 2.978 | 2.976 | 2.972 | 2.978 | 2.977 | 2.982 | 2.978 | 2.978 | 2.983 | 2.979 | 2.977 | 2.984 | 2.985 |
| Mn/(Mn+Fe) | 0.402 | 0.450 | 0.482 | 0.487 | 0.493 | 0.474 | 0.495 | 0.495 | 0.492 | 0.501 | 0.521 | 0.483 | 0.481 | 0.484 | 0.470 | 0.477 |
| Ta/(Ta+Nb) | 0.476 | 0.499 | 0.513 | 0.400 | 0.577 | 0.511 | 0.605 | 0.608 | 0.600 | 0.598 | 0.509 | 0.572 | 0.583 | 0.590 | 0.428 | 0.470 |
| Comments: |  |  |  |  |  | KH traverse |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  | Emerald Fields Resource Corporation sample |  |  |  |  |  |  |  |  |

**SW Beryl pegmatite**

EFR-6056B

| | KH13 | KH14 | KH15 | KH16 | KH17 | KK1 | KK2 | KK3 | KK4 | KK5 | KK6 | KK7 | KK8 | KK9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.80 | 8.55 | 10.17 | 8.86 | 8.70 | 10.47 | 8.89 | 10.03 | 9.54 | 10.68 | 9.76 | 9.96 | 9.87 | 9.18 |
| MnO | 7.19 | 7.46 | 6.97 | 6.39 | 8.15 | 7.13 | 8.23 | 6.83 | 7.53 | 7.50 | 6.34 | 6.46 | 6.50 | 7.39 |
| TiO2 | 0.37 | 0.36 | 0.39 | 0.35 | 0.27 | 0.28 | 0.26 | 0.30 | 0.30 | 0.27 | 0.38 | 0.36 | 0.30 | 0.29 |
| Nb2O5 | 30.95 | 30.86 | 41.41 | 31.53 | 42.34 | 48.73 | 42.76 | 41.68 | 44.29 | 54.20 | 30.21 | 34.73 | 35.92 | 40.13 |
| Ta2O5 | 51.65 | 51.87 | 40.26 | 50.98 | 39.55 | 31.55 | 38.94 | 40.10 | 36.69 | 26.49 | 51.79 | 47.62 | 45.67 | 41.63 |
| SnO2 | 0.14 | 0.14 | 0.06 | 0.16 | 0.05 | 0.04 | 0.05 | 0.09 | 0.05 | 0.04 | 0.11 | 0.06 | 0.08 | 0.00 |
| WO3 | 0.46 | 0.58 | 0.39 | 0.51 | 0.47 | 0.42 | 0.36 | 0.38 | 0.33 | 0.23 | 0.63 | 0.39 | 0.46 | 0.33 |
| PbO | 0.09 | 0.11 | 0.18 | 0.05 | 0.19 | 0.19 | 0.20 | 0.20 | 0.23 | 0.31 | 0.16 | 0.15 | 0.19 | 0.15 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.09 | 0.03 | 0.00 | 0.00 | 0.00 | 0.13 | 0.00 | 0.00 | 0.13 | 0.02 | 0.00 | 0.00 | 0.00 | 0.08 |
| CaO | 0.02 | 0.02 | 0.03 | 0.89 | 0.05 | 0.01 | 0.01 | 0.02 | 0.06 | 0.01 | 0.01 | 0.02 | 0.02 | 0.01 |
| Total | 99.74 | 99.97 | 99.86 | 99.76 | 99.77 | 98.95 | 99.69 | 99.64 | 99.13 | 99.75 | 99.39 | 99.74 | 99.00 | 99.19 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Fe | 0.521 | 0.506 | 0.570 | 0.522 | 0.486 | 0.569 | 0.496 | 0.563 | 0.529 | 0.562 | 0.582 | 0.579 | 0.574 | 0.521 |
| Mn | 0.431 | 0.447 | 0.395 | 0.381 | 0.461 | 0.392 | 0.465 | 0.388 | 0.423 | 0.400 | 0.383 | 0.380 | 0.382 | 0.424 |
| Ti | 0.019 | 0.019 | 0.019 | 0.019 | 0.014 | 0.014 | 0.013 | 0.015 | 0.015 | 0.013 | 0.021 | 0.019 | 0.016 | 0.015 |
| Nb | 0.991 | 0.987 | 1.254 | 1.004 | 1.278 | 1.432 | 1.289 | 1.264 | 1.329 | 1.543 | 0.975 | 1.091 | 1.128 | 1.231 |
| Ta | 0.995 | 0.998 | 0.733 | 0.977 | 0.718 | 0.558 | 0.706 | 0.732 | 0.662 | 0.454 | 1.005 | 0.900 | 0.863 | 0.768 |
| Sn | 0.004 | 0.004 | 0.001 | 0.004 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.003 | 0.002 | 0.002 | 0.000 |
| W | 0.008 | 0.011 | 0.007 | 0.009 | 0.008 | 0.007 | 0.006 | 0.007 | 0.006 | 0.004 | 0.012 | 0.007 | 0.008 | 0.006 |
| Pb | 0.002 | 0.002 | 0.003 | 0.001 | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.005 | 0.003 | 0.003 | 0.004 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.002 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.008 | 0.001 | 0.000 | 0.000 | 0.000 | 0.005 |
| Ca | 0.002 | 0.002 | 0.002 | 0.067 | 0.004 | 0.000 | 0.001 | 0.001 | 0.004 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Total | 2.978 | 2.977 | 2.985 | 2.986 | 2.974 | 2.984 | 2.980 | 2.976 | 2.982 | 2.984 | 2.984 | 2.980 | 2.978 | 2.973 |
| | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.453 | 0.469 | 0.409 | 0.422 | 0.487 | 0.408 | 0.484 | 0.408 | 0.444 | 0.416 | 0.397 | 0.396 | 0.400 | 0.449 |
| Ta/(Ta+Nb) | 0.501 | 0.503 | 0.369 | 0.493 | 0.360 | 0.280 | 0.354 | 0.367 | 0.333 | 0.227 | 0.508 | 0.452 | 0.433 | 0.384 |

Comments:

Emerald Fields Resource Corporation sample

KK traverse col. contains microlite incls.
slightly radiating crystals
with marginal patchy zonation

| | SW Petalite pegmatite | | | | | | | | | | | SW Beryl peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EFR-6059 | | | | | | | | | | | EFR-6067A | |
| | PJ | PK | RA | RB | RC | RD | RE | RF | PM | RG | RH | FA | FB |
| FeO | 4.05 | 4.13 | 3.82 | 4.08 | 4.09 | 4.04 | 4.03 | 4.48 | 4.55 | 4.16 | 4.50 | 10.65 | 11.15 |
| MnO | 11.56 | 11.13 | 11.26 | 11.21 | 11.05 | 10.72 | 10.82 | 12.70 | 14.10 | 11.24 | 12.53 | 5.87 | 5.82 |
| TiO2 | 0.11 | 0.04 | 0.22 | 0.07 | 0.02 | 0.09 | 0.08 | 0.27 | 0.37 | 0.11 | 0.31 | 1.27 | 1.20 |
| Nb2O5 | 21.94 | 18.38 | 19.42 | 20.13 | 17.91 | 15.11 | 15.71 | 41.10 | 55.43 | 22.15 | 39.63 | 38.85 | 41.29 |
| Ta2O5 | 60.56 | 64.30 | 63.48 | 63.62 | 66.15 | 68.95 | 68.25 | 40.01 | 23.67 | 61.09 | 42.17 | 40.62 | 39.17 |
| SnO2 | 0.21 | 0.20 | 0.31 | 0.12 | 0.15 | 0.10 | 0.10 | 0.06 | 0.48 | 0.38 | 0.09 | 0.30 | 0.25 |
| WO3 | 0.06 | 0.10 | 0.34 | 0.20 | 0.23 | 0.15 | 0.14 | 0.36 | 0.24 | 0.20 | 0.30 | 1.08 | 0.94 |
| PbO | 0.14 | 0.14 | 0.18 | 0.10 | 0.30 | 0.08 | 0.15 | 0.40 | 0.07 | 0.19 | 0.46 | 0.19 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.04 | 0.11 | 0.06 | 0.00 | 0.00 | 0.16 | 0.00 | 0.04 | 0.04 | 0.10 | 0.56 | 0.18 |
| CaO | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.15 | 0.00 |
| Total | 98.65 | 98.50 | 99.13 | 99.58 | 99.91 | 99.26 | 99.42 | 99.42 | 98.96 | 99.55 | 100.11 | 99.55 | 100.15 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.255 | 0.266 | 0.243 | 0.258 | 0.262 | 0.264 | 0.262 | 0.253 | 0.239 | 0.260 | 0.254 | 0.598 | 0.618 |
| Mn | 0.738 | 0.727 | 0.726 | 0.718 | 0.716 | 0.710 | 0.712 | 0.725 | 0.749 | 0.711 | 0.717 | 0.334 | 0.326 |
| Ti | 0.006 | 0.002 | 0.013 | 0.004 | 0.001 | 0.005 | 0.005 | 0.014 | 0.018 | 0.006 | 0.016 | 0.064 | 0.060 |
| Nb | 0.748 | 0.641 | 0.668 | 0.688 | 0.620 | 0.534 | 0.552 | 1.252 | 1.571 | 0.748 | 1.210 | 1.180 | 1.237 |
| Ta | 1.241 | 1.349 | 1.313 | 1.308 | 1.376 | 1.465 | 1.442 | 0.733 | 0.404 | 1.241 | 0.774 | 0.742 | 0.706 |
| Sn | 0.006 | 0.006 | 0.009 | 0.003 | 0.005 | 0.003 | 0.003 | 0.002 | 0.012 | 0.011 | 0.002 | 0.008 | 0.007 |
| W | 0.001 | 0.002 | 0.007 | 0.004 | 0.005 | 0.003 | 0.003 | 0.006 | 0.004 | 0.004 | 0.005 | 0.019 | 0.016 |
| Pb | 0.003 | 0.003 | 0.004 | 0.002 | 0.006 | 0.002 | 0.003 | 0.007 | 0.001 | 0.004 | 0.008 | 0.004 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.002 | 0.003 | 0.007 | 0.004 | 0.000 | 0.000 | 0.010 | 0.000 | 0.002 | 0.003 | 0.006 | 0.033 | 0.010 |
| Ca | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.011 | 0.000 |
| Total | 3.001 | 3.002 | 2.990 | 2.989 | 2.991 | 2.987 | 2.991 | 2.994 | 3.000 | 2.989 | 2.992 | 2.992 | 2.982 |
| Mn/(Mn+Fe) | 0.743 | 0.732 | 0.749 | 0.736 | 0.732 | 0.729 | 0.731 | 0.742 | 0.758 | 0.732 | 0.738 | 0.358 | 0.346 |
| Ta/(Ta+Nb) | 0.624 | 0.678 | 0.663 | 0.655 | 0.690 | 0.733 | 0.723 | 0.369 | 0.204 | 0.624 | 0.390 | 0.386 | 0.363 |
| Comments: | PJ, PK, RA - RF | | RA - RE core to rim | | | | | | PM, RG & RH | | | FA & FB | |
| | same grain | | strong oscillatory zonation | | | | | patchy | same grain | | | same grain | |
| | Emerald Fields Resource Corporation sample | | | | | | | alteration | patchy | | patchy | mantled by wodg. | |

| | | | | Zone 11 pegmatite | | | | | | | | SW Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | EFR-6082 | | | | | | | | EFR-6090 | | | | |
| | DA | DB | DC | RP | RQ | RR | RS | TF | SA | SB | SC | SE | SF | SG | SM | GO |
| FeO | 17.63 | 17.05 | 17.59 | 17.55 | 17.29 | 17.29 | 17.68 | 16.17 | 16.27 | 15.23 | 13.63 | 13.90 | 13.46 | 14.18 | 13.71 | 13.26 |
| MnO | 2.66 | 2.50 | 2.70 | 2.56 | 2.63 | 3.35 | 2.79 | 3.02 | 3.38 | 3.11 | 2.96 | 3.15 | 2.97 | 3.02 | 2.93 | 2.89 |
| TiO2 | 1.45 | 3.05 | 1.74 | 1.75 | 1.99 | 0.85 | 1.45 | 1.12 | 0.90 | 0.97 | 0.99 | 1.12 | 0.99 | 1.18 | 1.69 | 0.91 |
| Nb2O5 | 70.10 | 69.03 | 71.45 | 68.47 | 67.33 | 70.04 | 69.29 | 60.34 | 65.27 | 51.78 | 33.89 | 40.37 | 32.84 | 43.17 | 39.31 | 30.83 |
| Ta2O5 | 4.80 | 4.77 | 4.01 | 7.16 | 6.92 | 6.34 | 6.23 | 17.48 | 10.94 | 25.33 | 46.28 | 38.53 | 47.68 | 37.33 | 38.80 | 49.66 |
| SnO2 | 0.17 | 0.35 | 0.13 | 0.10 | 0.19 | 0.08 | 0.10 | 0.10 | 0.03 | 0.04 | 0.29 | 0.18 | 0.30 | 0.19 | 0.29 | 0.29 |
| WO3 | 0.74 | 0.57 | 0.66 | 0.52 | 0.73 | 0.63 | 0.63 | 0.60 | 0.55 | 0.84 | 0.58 | 0.70 | 0.67 | 0.58 | 0.65 | 0.55 |
| PbO | 0.77 | 0.77 | 0.73 | 0.63 | 0.66 | 0.83 | 0.75 | 0.64 | 0.67 | 0.60 | 0.23 | 0.35 | 0.42 | 0.42 | 0.53 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.41 | 0.49 | 0.17 | 0.34 | 0.29 | 0.19 | 0.34 | 0.35 | 0.10 | 0.12 | 0.30 | 0.61 | 0.18 |
| CaO | 0.02 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.02 | 0.01 | 0.03 | 0.00 |
| Total | 98.33 | 98.09 | 99.04 | 99.16 | 98.23 | 99.61 | 99.27 | 99.76 | 98.21 | 98.23 | 99.19 | 98.45 | 99.45 | 100.36 | 98.56 | 98.78 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.862 | 0.829 | 0.849 | 0.856 | 0.850 | 0.842 | 0.860 | 0.820 | 0.817 | 0.814 | 0.792 | 0.786 | 0.787 | 0.778 | 0.773 | 0.788 |
| Mn | 0.132 | 0.123 | 0.132 | 0.126 | 0.131 | 0.165 | 0.137 | 0.155 | 0.172 | 0.168 | 0.174 | 0.180 | 0.176 | 0.168 | 0.167 | 0.174 |
| Ti | 0.064 | 0.133 | 0.075 | 0.077 | 0.088 | 0.037 | 0.064 | 0.051 | 0.041 | 0.047 | 0.052 | 0.057 | 0.052 | 0.058 | 0.086 | 0.049 |
| Nb | 1.853 | 1.815 | 1.865 | 1.804 | 1.790 | 1.843 | 1.823 | 1.654 | 1.772 | 1.496 | 1.065 | 1.234 | 1.038 | 1.280 | 1.198 | 0.990 |
| Ta | 0.076 | 0.076 | 0.063 | 0.113 | 0.111 | 0.100 | 0.099 | 0.288 | 0.179 | 0.440 | 0.874 | 0.708 | 0.906 | 0.666 | 0.711 | 0.959 |
| Sn | 0.004 | 0.008 | 0.003 | 0.002 | 0.004 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.008 | 0.005 | 0.008 | 0.005 | 0.008 | 0.008 |
| W | 0.011 | 0.009 | 0.010 | 0.008 | 0.011 | 0.009 | 0.010 | 0.009 | 0.009 | 0.014 | 0.010 | 0.012 | 0.012 | 0.010 | 0.011 | 0.010 |
| Pb | 0.012 | 0.012 | 0.011 | 0.010 | 0.010 | 0.013 | 0.012 | 0.010 | 0.011 | 0.010 | 0.004 | 0.006 | 0.008 | 0.007 | 0.010 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.021 | 0.025 | 0.009 | 0.017 | 0.015 | 0.010 | 0.019 | 0.021 | 0.006 | 0.007 | 0.017 | 0.036 | 0.011 |
| Ca | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.000 | 0.002 | 0.000 |
| Total | 3.016 | 3.006 | 3.009 | 3.018 | 3.021 | 3.022 | 3.024 | 3.006 | 3.010 | 3.010 | 3.000 | 2.998 | 2.995 | 2.990 | 3.002 | 2.993 |
| Mn/(Mn+Fe) | 0.133 | 0.129 | 0.135 | 0.129 | 0.133 | 0.164 | 0.138 | 0.159 | 0.174 | 0.171 | 0.180 | 0.187 | 0.182 | 0.177 | 0.178 | 0.181 |
| Ta/(Ta+Nb) | 0.040 | 0.040 | 0.033 | 0.059 | 0.058 | 0.052 | 0.051 | 0.148 | 0.092 | 0.227 | 0.451 | 0.365 | 0.466 | 0.342 | 0.373 | 0.492 |
| Comments: | | DA & DB | | RP & RQ | | | | oscill. | | SA - SC | | Emerald Fields Resource Corporation sample | | | | |
| | | same grain | | same grain | | | | zoned | | same grain | | | | | | |
| | | unzoned | | Emerald Fields R.C. sample | | | | grain | rim | | core | | | | | |

| | Big Mack pegmatite<br>EFR-6099 | | | | |
|---|---|---|---|---|---|
| | RA | RB | RG | RH | RI |
| FeO | 16.62 | 17.03 | 16.40 | 16.55 | 16.78 |
| MnO | 3.08 | 2.37 | 2.62 | 2.49 | 2.70 |
| $TiO_2$ | 0.98 | 1.07 | 0.76 | 1.99 | 0.81 |
| $Nb_2O_5$ | 63.74 | 62.35 | 54.79 | 55.71 | 59.66 |
| $Ta_2O_5$ | 12.77 | 14.88 | 23.40 | 19.64 | 18.03 |
| $SnO_2$ | 1.17 | 1.14 | 0.82 | 1.67 | 0.51 |
| $WO_3$ | 0.34 | 0.29 | 0.30 | 0.28 | 0.29 |
| PbO | 0.10 | 0.10 | 0.10 | 0.31 | 0.08 |
| $ThO_2$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $UO_2$ | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 |
| $Sb_2O_3$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Bi_2O_3$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Sc_2O_3$ | 0.05 | 0.15 | 0.17 | 0.04 | 0.05 |
| CaO | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 |
| Total | 98.87 | 99.40 | 99.36 | 98.68 | 98.92 |
| | **Structural formulae<br>based on 6 oxygens** | | | | |
| Fe | 0.834 | 0.856 | 0.857 | 0.857 | 0.860 |
| Mn | 0.157 | 0.121 | 0.139 | 0.131 | 0.140 |
| Ti | 0.044 | 0.049 | 0.036 | 0.092 | 0.037 |
| Nb | 1.729 | 1.694 | 1.547 | 1.559 | 1.652 |
| Ta | 0.208 | 0.243 | 0.397 | 0.330 | 0.300 |
| Sn | 0.028 | 0.027 | 0.020 | 0.041 | 0.012 |
| W | 0.005 | 0.004 | 0.005 | 0.004 | 0.005 |
| Pb | 0.002 | 0.002 | 0.002 | 0.005 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.003 | 0.008 | 0.009 | 0.002 | 0.003 |
| Ca | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 |
| Total | 3.011 | 3.005 | 3.013 | 3.022 | 3.011 |
| Mn/(Mn+Fe) | 0.158 | 0.124 | 0.139 | 0.132 | 0.140 |
| Ta/(Ta+Nb) | 0.108 | 0.126 | 0.204 | 0.175 | 0.154 |
| Comments: | | | RG & RH | | |
| | Emerald Fields | | same grain | | |
| | sample | | associated with nigerite | | |

## Wodginite Group

|  | **S.R. Pluton** |  |  |  |  |  |  | **East Beryl pegmatite** |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 93-260C |  |  |  |  |  |  | 93-265A |  |  |  |  |  |
| **Raw data** | AO | AY | ZA | ZE1 | ZE2 | ZI | ZL | ZS | ZY | ZZ | ZO | ZP | ZQ |
| FeO | 5.84 | 3.55 | 0.55 | 0.59 | 0.67 | 0.53 | 0.75 | 0.58 | 0.48 | 0.51 | 0.59 | 0.49 | 0.51 |
| MnO | 6.50 | 8.19 | 12.19 | 12.74 | 12.31 | 13.47 | 13.13 | 13.36 | 11.95 | 12.43 | 12.82 | 12.89 | 13.15 |
| TiO2 | 0.16 | 0.14 | 0.10 | 0.08 | 0.08 | 0.11 | 0.08 | 0.05 | 0.13 | 0.10 | 0.11 | 0.11 | 0.11 |
| Nb2O5 | 7.48 | 5.82 | 7.78 | 7.17 | 6.63 | 9.06 | 7.28 | 7.27 | 3.07 | 7.66 | 8.08 | 8.32 | 8.53 |
| Ta2O5 | 61.42 | 62.74 | 61.80 | 60.72 | 62.80 | 59.09 | 57.88 | 57.51 | 69.71 | 61.82 | 58.42 | 59.99 | 58.32 |
| SnO2 | 15.23 | 15.10 | 16.45 | 15.91 | 15.35 | 12.70 | 13.78 | 14.49 | 13.21 | 15.55 | 15.13 | 14.81 | 14.00 |
| WO3 | 0.10 | 0.07 | 1.22 | 3.26 | 2.61 | 5.07 | 7.70 | 7.69 | 1.65 | 2.51 | 5.02 | 3.58 | 5.63 |
| PbO | 0.01 | 0.03 | 0.00 | 0.05 | 0.00 | 0.00 | 0.23 | 0.02 | 0.00 | 0.00 | 0.02 | 0.07 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.21 | 0.10 |  |  |  |  |  |  |  |  |  |  |  |
| Sb2O3 | 0.00 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |
| Bi2O3 | 0.00 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |
| Total | 96.54 | 95.37 | 100.09 | 100.52 | 100.45 | 100.03 | 100.83 | 100.97 | 100.20 | 100.58 | 100.21 | 100.29 | 100.27 |
| Recalculated | 93-260C |  |  |  |  |  |  | 93-265A |  |  |  |  |  |
| oxides | AO | AY | ZA | ZE | ZE | ZI | ZL | ZS | ZY | ZZ | ZO | ZP | ZQ |
| Li2O | 0.03 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 4.29 | 2.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MnO | 6.50 | 8.19 | 12.19 | 12.74 | 12.31 | 13.47 | 13.13 | 13.36 | 11.95 | 12.43 | 12.82 | 12.89 | 13.15 |
| Fe2O3 | 1.69 | 1.58 | 0.61 | 0.66 | 0.74 | 0.59 | 0.83 | 0.64 | 0.53 | 0.57 | 0.66 | 0.54 | 0.57 |
| TiO2 | 0.16 | 0.14 | 0.10 | 0.08 | 0.08 | 0.11 | 0.08 | 0.05 | 0.13 | 0.10 | 0.11 | 0.11 | 0.11 |
| Nb2O5 | 7.48 | 5.82 | 7.78 | 7.17 | 6.63 | 9.06 | 7.28 | 7.27 | 3.07 | 7.66 | 8.08 | 8.32 | 8.53 |
| Ta2O5 | 61.42 | 62.74 | 61.80 | 60.72 | 62.80 | 59.09 | 57.88 | 57.51 | 69.71 | 61.82 | 58.42 | 59.99 | 58.32 |
| SnO2 | 15.23 | 15.10 | 16.45 | 15.91 | 15.35 | 12.70 | 13.78 | 14.49 | 13.21 | 15.55 | 15.13 | 14.81 | 14.00 |
| WO3 | 0.10 | 0.07 | 1.22 | 3.26 | 2.61 | 5.07 | 7.70 | 7.69 | 1.65 | 2.51 | 5.02 | 3.58 | 5.63 |
| PbO | 0.01 | 0.03 | 0.00 | 0.05 | 0.00 | 0.00 | 0.23 | 0.02 | 0.00 | 0.00 | 0.02 | 0.07 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.21 | 0.10 |  |  |  |  |  |  |  |  |  |  |  |
| Sb2O3 | 0.00 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |
| Bi2O3 | 0.00 | 0.00 |  |  |  |  |  |  |  |  |  |  |  |
| Total | 97.13 | 95.98 | 100.15 | 100.59 | 100.52 | 100.09 | 100.91 | 101.03 | 100.25 | 100.64 | 100.28 | 100.34 | 100.33 |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.061 | 0.144 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe2+ | 1.559 | 0.783 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn | 2.380 | 3.069 | 4.345 | 4.527 | 4.399 | 4.759 | 4.634 | 4.704 | 4.401 | 4.412 | 4.536 | 4.566 | 4.642 |
| Fe3+ | 0.552 | 0.529 | 0.194 | 0.207 | 0.236 | 0.185 | 0.261 | 0.202 | 0.175 | 0.179 | 0.206 | 0.171 | 0.178 |
| Ti | 0.052 | 0.048 | 0.032 | 0.025 | 0.025 | 0.035 | 0.025 | 0.016 | 0.043 | 0.032 | 0.035 | 0.035 | 0.034 |
| Nb | 1.462 | 1.164 | 1.480 | 1.360 | 1.265 | 1.708 | 1.371 | 1.366 | 0.603 | 1.451 | 1.526 | 1.573 | 1.607 |
| Ta | 7.220 | 7.547 | 7.072 | 6.928 | 7.205 | 6.702 | 6.559 | 6.502 | 8.242 | 7.045 | 6.637 | 6.823 | 6.610 |
| Sn | 2.625 | 2.664 | 2.760 | 2.662 | 2.582 | 2.112 | 2.289 | 2.402 | 2.290 | 2.598 | 2.520 | 2.470 | 2.327 |
| W | 0.011 | 0.008 | 0.133 | 0.354 | 0.285 | 0.548 | 0.831 | 0.829 | 0.186 | 0.273 | 0.544 | 0.388 | 0.608 |
| Pb | 0.001 | 0.004 | 0.000 | 0.006 | 0.000 | 0.000 | 0.026 | 0.002 | 0.000 | 0.000 | 0.002 | 0.008 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| Sc | 0.078 | 0.040 |  |  |  |  |  |  |  |  |  |  |  |
| Sb | 0.000 | 0.000 |  |  |  |  |  |  |  |  |  |  |  |
| Bi | 0.000 | 0.000 |  |  |  |  |  |  |  |  |  |  |  |
| Total | 16.000 | 16.000 | 16.016 | 16.069 | 15.998 | 16.049 | 15.997 | 16.022 | 15.940 | 15.990 | 16.008 | 16.037 | 16.008 |
| Comments: | core of large | | tungsteniferous wodginite |  |  |  |  |  |  |  |  |  |  |
|  | inclusion in |  | ZA and ZE from same crystal |  |  |  |  |  | ZY and Z adjacent |  |  |  |  |
|  | cassiterite |  |  |  |  |  |  |  | to ZK, L, M and S |  |  |  |  |
|  |  |  |  |  |  |  | wodginite - some tungsteniferous |  |  |  |  |  |  |
|  | wodginite |  | (Li2O, FeO and Fe2O3 values calculated using the method of Ercit et al. 1992) |  |  |  |  |  |  |  |  |  |  |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

**East Beryl pegmatite**

93-265A

| Raw data | SG | SH | SL | AA | AB | AC | AD | AE | AF | AG | AH | AI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 1.95 | 0.95 | 2.32 | 0.50 | 0.56 | 0.57 | 0.49 | 0.44 | 0.47 | 3.93 | 0.46 | 0.54 |
| MnO | 10.74 | 12.75 | 16.54 | 13.01 | 12.36 | 19.66 | 12.42 | 12.74 | 12.09 | 15.88 | 11.90 | 12.96 |
| TiO2 | 0.08 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Nb2O5 | 7.13 | 6.51 | 4.00 | 7.75 | 7.08 | 2.19 | 7.83 | 7.25 | 7.54 | 5.51 | 6.99 | 6.69 |
| Ta2O5 | 53.83 | 55.80 | 34.67 | 53.84 | 54.90 | 12.66 | 55.30 | 54.39 | 58.66 | 21.95 | 58.65 | 52.32 |
| SnO2 | 13.75 | 13.48 | 8.10 | 14.06 | 14.94 | 3.02 | 14.60 | 14.70 | 15.34 | 5.00 | 16.57 | 14.11 |
| WO3 | 7.82 | 10.50 | 34.63 | 11.01 | 9.53 | 60.80 | 8.41 | 9.98 | 5.59 | 45.25 | 5.06 | 13.39 |
| PbO | 0.99 | 0.13 | 0.14 | 0.00 | 0.00 | 0.06 | 0.00 | 0.01 | 0.00 | 0.22 | 0.04 | 0.02 |
| ThO2 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.43 | 0.23 | 0.00 | 0.12 | 0.01 | 0.18 | 0.00 | 0.00 | 0.13 | 0.03 | 0.11 | 0.11 |
| Sc2O3 | 0.03 | 0.02 | 0.02 | 0.07 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.51 | 0.00 | 0.00 |
| Sb2O3 | 0.08 | 0.06 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 2.35 | 0.29 | 0.26 | 0.00 | 0.02 | 0.04 | 0.02 | 0.00 | 0.00 | 0.34 | 0.00 | 0.02 |
| Total | 99.19 | 100.78 | 100.77 | 100.36 | 99.39 | 99.18 | 99.09 | 99.51 | 99.83 | 98.63 | 99.78 | 100.16 |

93-265A

| Recalculated oxides | SG | SH | SL | AA | AB | AC | AD | AE | AF | AG | AH | AI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MnO | 10.74 | 12.75 | 16.54 | 13.01 | 12.36 | 19.66 | 12.42 | 12.74 | 12.09 | 15.88 | 11.90 | 12.96 |
| Fe2O3 | 2.15 | 1.06 | 2.58 | 0.56 | 0.63 | 0.63 | 0.55 | 0.49 | 0.52 | 4.37 | 0.51 | 0.60 |
| TiO2 | 0.08 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Nb2O5 | 7.13 | 6.51 | 4.00 | 7.75 | 7.08 | 2.19 | 7.83 | 7.25 | 7.54 | 5.51 | 6.99 | 6.69 |
| Ta2O5 | 53.83 | 55.80 | 34.67 | 53.84 | 54.90 | 12.66 | 55.30 | 54.39 | 58.66 | 21.95 | 58.65 | 52.32 |
| SnO2 | 13.75 | 13.48 | 8.10 | 14.06 | 14.94 | 3.02 | 14.60 | 14.70 | 15.34 | 5.00 | 16.57 | 14.11 |
| WO3 | 7.82 | 10.50 | 34.63 | 11.01 | 9.53 | 60.80 | 8.41 | 9.98 | 5.59 | 45.25 | 5.06 | 13.39 |
| PbO | 0.99 | 0.13 | 0.14 | 0.00 | 0.00 | 0.06 | 0.00 | 0.01 | 0.00 | 0.22 | 0.04 | 0.02 |
| ThO2 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.43 | 0.23 | 0.00 | 0.12 | 0.01 | 0.18 | 0.00 | 0.00 | 0.13 | 0.03 | 0.11 | 0.11 |
| Sc2O3 | 0.03 | 0.02 | 0.02 | 0.07 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.51 | 0.00 | 0.00 |
| Sb2O3 | 0.08 | 0.06 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 2.35 | 0.29 | 0.26 | 0.00 | 0.02 | 0.04 | 0.02 | 0.00 | 0.00 | 0.34 | 0.00 | 0.02 |
| Total | 99.39 | 100.89 | 101.03 | 100.41 | 99.46 | 99.24 | 99.15 | 99.56 | 99.88 | 99.06 | 99.83 | 100.22 |

**Structural formulae based on 32 oxygens**

| | SG | SH | SL | AA | AB | AC | AD | AE | AF | AG | AH | AI |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe2+ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn | 3.890 | 4.511 | 5.699 | 4.583 | 4.418 | 6.811 | 4.442 | 4.541 | 4.317 | 5.409 | 4.265 | 4.591 |
| Fe3+ | 0.697 | 0.332 | 0.789 | 0.175 | 0.199 | 0.195 | 0.174 | 0.156 | 0.166 | 1.322 | 0.163 | 0.189 |
| Ti | 0.026 | 0.019 | 0.018 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 |
| Nb | 1.379 | 1.229 | 0.736 | 1.458 | 1.350 | 0.405 | 1.495 | 1.379 | 1.438 | 1.001 | 1.337 | 1.265 |
| Ta | 6.261 | 6.339 | 3.835 | 6.090 | 6.300 | 1.408 | 6.349 | 6.227 | 6.728 | 2.400 | 6.747 | 5.950 |
| Sn | 2.345 | 2.245 | 1.314 | 2.331 | 2.514 | 0.492 | 2.458 | 2.467 | 2.580 | 0.802 | 2.795 | 2.353 |
| W | 0.867 | 1.137 | 3.651 | 1.187 | 1.042 | 6.445 | 0.920 | 1.089 | 0.611 | 4.715 | 0.555 | 1.451 |
| Pb | 0.114 | 0.015 | 0.015 | 0.000 | 0.000 | 0.006 | 0.000 | 0.001 | 0.000 | 0.024 | 0.005 | 0.003 |
| Th | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.041 | 0.021 | 0.000 | 0.011 | 0.001 | 0.016 | 0.000 | 0.000 | 0.012 | 0.002 | 0.010 | 0.010 |
| Sc | 0.011 | 0.007 | 0.007 | 0.024 | 0.000 | 0.000 | 0.005 | 0.006 | 0.000 | 0.178 | 0.000 | 0.000 |
| Sb | 0.014 | 0.010 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.259 | 0.031 | 0.027 | 0.000 | 0.002 | 0.004 | 0.002 | 0.000 | 0.000 | 0.036 | 0.000 | 0.002 |
| Total | 15.905 | 15.898 | 16.096 | 15.861 | 15.826 | 15.783 | 15.845 | 15.865 | 15.853 | 15.892 | 15.877 | 15.815 |
| Comments: | high Bi | | high W | | | high W | | | | high W | | |

wodginite - some tungsteniferous

## Wodginite Group

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **East Beryl pegmatite** | | | | | | | **East Beryl pegmatite** | | | | |
| | | | 93-265AM | | | | | | | 93-265AM | | | | |
| **Raw data** | KB | KJ | KK | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK |
| FeO | 0.47 | 0.68 | 0.57 | 0.44 | 0.45 | 0.44 | 0.51 | 0.48 | 0.81 | 0.40 | 0.44 | 0.44 | 0.49 | 0.46 |
| MnO | 12.02 | 11.67 | 11.56 | 11.42 | 12.07 | 11.95 | 11.93 | 11.92 | 11.19 | 11.79 | 11.72 | 11.70 | 12.00 | 11.83 |
| $TiO_2$ | 0.02 | 0.14 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 |
| $Nb_2O_5$ | 7.20 | 2.83 | 6.14 | 6.02 | 6.15 | 5.54 | 8.28 | 7.74 | 7.86 | 6.72 | 5.95 | 6.02 | 7.33 | 7.34 |
| $Ta_2O_5$ | 61.47 | 67.41 | 61.29 | 63.29 | 62.42 | 60.55 | 60.24 | 61.03 | 59.98 | 62.68 | 64.35 | 63.29 | 59.56 | 61.01 |
| $SnO_2$ | 17.56 | 14.12 | 17.06 | 17.49 | 15.37 | 16.06 | 15.61 | 15.97 | 16.77 | 16.73 | 15.71 | 15.89 | 16.18 | 16.45 |
| $WO_3$ | 1.73 | 2.66 | 2.79 | 1.71 | 4.09 | 5.30 | 3.60 | 3.14 | 2.45 | 2.44 | 1.74 | 2.80 | 4.49 | 2.71 |
| PbO | 0.02 | 0.10 | 0.12 | 0.00 | 0.00 | 0.01 | 0.05 | 0.00 | 0.10 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 |
| $ThO_2$ | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $UO_2$ | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Sc_2O_3$ | 0.00 | 0.00 | 0.00 | 0.11 | 0.09 | 0.02 | 0.20 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| $Sb_2O_3$ | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Bi_2O_3$ | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| **Total** | 100.53 | 99.86 | 99.64 | 100.50 | 100.64 | 99.87 | 100.45 | 100.29 | 99.19 | 100.77 | 99.93 | 100.16 | 100.12 | 99.81 |
| **Recalculated** | | | | | | | 93-265AM | | | | | | | |
| **oxides** | KB | KJ | KK | AA | AB | AC | AD | AE | AF | AG | AH | AI | AJ | AK |
| $Li_2O$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| MnO | 12.02 | 11.67 | 11.56 | 11.42 | 12.07 | 11.95 | 11.93 | 11.92 | 11.19 | 11.79 | 11.72 | 11.70 | 12.00 | 11.83 |
| $Fe_2O_3$ | 0.52 | 0.76 | 0.63 | 0.49 | 0.50 | 0.49 | 0.57 | 0.54 | 0.91 | 0.45 | 0.49 | 0.49 | 0.55 | 0.51 |
| $TiO_2$ | 0.02 | 0.14 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 |
| $Nb_2O_5$ | 7.20 | 2.83 | 6.14 | 6.02 | 6.15 | 5.54 | 8.28 | 7.74 | 7.86 | 6.72 | 5.95 | 6.02 | 7.33 | 7.34 |
| $Ta_2O_5$ | 61.47 | 67.41 | 61.29 | 63.29 | 62.42 | 60.55 | 60.24 | 61.03 | 59.98 | 62.68 | 64.35 | 63.29 | 59.56 | 61.01 |
| $SnO_2$ | 17.56 | 14.12 | 17.06 | 17.49 | 15.37 | 16.06 | 15.61 | 15.97 | 16.77 | 16.73 | 15.71 | 15.89 | 16.18 | 16.45 |
| $WO_3$ | 1.73 | 2.66 | 2.79 | 1.71 | 4.09 | 5.30 | 3.60 | 3.14 | 2.45 | 2.44 | 1.74 | 2.80 | 4.49 | 2.71 |
| PbO | 0.02 | 0.10 | 0.12 | 0.00 | 0.00 | 0.01 | 0.05 | 0.00 | 0.10 | 0.00 | 0.00 | 0.01 | 0.04 | 0.00 |
| $ThO_2$ | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $UO_2$ | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Sc_2O_3$ | 0.00 | 0.00 | 0.00 | 0.11 | 0.09 | 0.02 | 0.20 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| $Sb_2O_3$ | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Bi_2O_3$ | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| **Total** | 100.58 | 99.94 | 99.70 | 100.54 | 100.69 | 99.92 | 100.51 | 100.34 | 99.28 | 100.81 | 99.98 | 100.21 | 100.18 | 99.86 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | | |
| Li | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| $Fe^{2+}$ | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Mn | 4.281 | 4.306 | 4.173 | 4.101 | 4.319 | 4.315 | 4.222 | 4.244 | 4.019 | 4.208 | 4.245 | 4.219 | 4.280 | 4.241 |
| $Fe^{3+}$ | 0.165 | 0.248 | 0.203 | 0.157 | 0.158 | 0.158 | 0.180 | 0.170 | 0.289 | 0.142 | 0.159 | 0.156 | 0.173 | 0.161 |
| Ti | 0.006 | 0.046 | 0.032 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.007 | 0.002 |
| Nb | 1.369 | 0.557 | 1.183 | 1.154 | 1.174 | 1.068 | 1.563 | 1.471 | 1.506 | 1.280 | 1.149 | 1.159 | 1.396 | 1.405 |
| Ta | 7.029 | 7.986 | 7.104 | 7.296 | 7.173 | 7.020 | 6.845 | 6.977 | 6.915 | 7.182 | 7.482 | 7.329 | 6.820 | 7.022 |
| Sn | 2.944 | 2.453 | 2.899 | 2.957 | 2.590 | 2.730 | 2.601 | 2.677 | 2.834 | 2.810 | 2.679 | 2.699 | 2.717 | 2.776 |
| W | 0.189 | 0.300 | 0.308 | 0.188 | 0.448 | 0.586 | 0.390 | 0.342 | 0.269 | 0.267 | 0.193 | 0.309 | 0.490 | 0.297 |
| Pb | 0.002 | 0.012 | 0.014 | 0.000 | 0.000 | 0.001 | 0.005 | 0.000 | 0.011 | 0.000 | 0.000 | 0.001 | 0.005 | 0.000 |
| Th | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.040 | 0.034 | 0.006 | 0.071 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 |
| Sb | 0.000 | 0.018 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.003 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.004 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| **Total** | 15.990 | 15.939 | 15.918 | 15.894 | 15.897 | 15.884 | 15.880 | 15.882 | 15.849 | 15.890 | 15.908 | 15.873 | 15.887 | 15.906 |
| Comments: | | | | all are inclusions in large muscovite | | | | | AD - AH | | | | AJ & AK | |
| | assoc. Bi alteration | | | | | | | | same grain | | | | same grain | |
| | | | | | | | | near KB | | | | | | |
| | | | | | | | wodginite | | | | | | | |

## Wodginite Group

| | E Beryl | Audreys peg. | | Lou's peg. | | Lou's pegmatite | | | Lou's peg. | | James' |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-265P | 93-271 | | 93-272B | | 93-272D | | | 93-272E | | 93-276B |
| **Raw data** | WK | YD | YE | RH | RI | PF | PN | PO | WJ | JJ | PA |
| FeO | 4.92 | 11.49 | 11.45 | 10.69 | 10.15 | 9.24 | 9.62 | 9.43 | 11.14 | 12.44 | 10.10 |
| MnO | 9.19 | 2.24 | 2.14 | 3.43 | 3.34 | 4.31 | 4.05 | 4.15 | 2.62 | 2.15 | 3.82 |
| TiO2 | 1.56 | 0.95 | 0.90 | 4.14 | 3.05 | 1.30 | 1.39 | 1.36 | 4.71 | 4.17 | 2.53 |
| Nb2O5 | 9.03 | 9.83 | 10.25 | 14.75 | 13.03 | 10.46 | 10.29 | 10.43 | 14.14 | 17.77 | 13.73 |
| Ta2O5 | 59.04 | 57.48 | 56.77 | 53.94 | 55.35 | 59.54 | 60.34 | 60.27 | 54.63 | 52.42 | 55.73 |
| SnO2 | 14.92 | 11.49 | 10.94 | 10.36 | 10.63 | 12.80 | 12.84 | 12.68 | 9.86 | 10.45 | 11.28 |
| WO3 | 0.51 | 3.06 | 2.94 | 0.09 | 0.58 | 0.37 | 0.37 | 0.36 | 0.02 | 0.00 | 1.77 |
| PbO | 0.02 | 0.17 | 0.22 | 0.10 | 0.07 | 0.12 | 0.07 | 0.15 | 0.51 | 0.03 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.34 | 0.35 | 0.14 | 0.17 | 0.09 | 0.05 | 0.12 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.02 | 0.57 | 0.57 | 0.44 | 0.28 | 0.13 | 0.13 | 0.11 | | 0.46 | |
| Sb2O3 | 0.02 | 0.00 | 0.00 | 0.03 | 0.11 | 0.03 | 0.00 | 0.05 | | 0.00 | |
| Bi2O3 | 0.02 | | | | | | | | | | |
| Total | 99.27 | 97.62 | 96.53 | 98.15 | 96.76 | 98.39 | 99.15 | 99.12 | 97.64 | 99.89 | 98.99 |
| **Recalculated** | 93-265P | 93-271 | | 93-272B | | 93-272D | | | 93-272E | | 93-276B |
| **oxides** | WK | YD | YE | RH | RI | PF | PN | PO | WJ | WJ | PA |
| Li2O | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 |
| FeO | 2.81 | 9.05 | 8.97 | 8.99 | 8.36 | 7.15 | 7.52 | 7.34 | 9.39 | 10.64 | 7.79 |
| MnO | 9.19 | 2.24 | 2.14 | 3.43 | 3.34 | 4.31 | 4.05 | 4.15 | 2.62 | 2.15 | 3.82 |
| Fe2O3 | 2.33 | 2.63 | 2.67 | 1.83 | 1.94 | 2.29 | 2.30 | 2.29 | 1.93 | 1.94 | 2.53 |
| TiO2 | 1.56 | 0.95 | 0.90 | 4.14 | 3.05 | 1.30 | 1.39 | 1.36 | 4.71 | 4.17 | 2.53 |
| Nb2O5 | 9.03 | 9.83 | 10.25 | 14.75 | 13.03 | 10.46 | 10.29 | 10.43 | 14.14 | 17.77 | 13.73 |
| Ta2O5 | 59.04 | 57.48 | 56.77 | 53.94 | 55.35 | 59.54 | 60.34 | 60.27 | 54.63 | 52.42 | 55.73 |
| SnO2 | 14.92 | 11.49 | 10.94 | 10.36 | 10.63 | 12.80 | 12.84 | 12.68 | 9.86 | 10.45 | 11.28 |
| WO3 | 0.51 | 3.06 | 2.94 | 0.09 | 0.58 | 0.37 | 0.37 | 0.36 | 0.02 | 0.00 | 1.77 |
| PbO | 0.02 | 0.17 | 0.22 | 0.10 | 0.07 | 0.12 | 0.07 | 0.15 | 0.51 | 0.03 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.34 | 0.35 | 0.14 | 0.17 | 0.09 | 0.05 | 0.12 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.02 | 0.57 | 0.57 | 0.44 | 0.28 | 0.13 | 0.13 | 0.11 | | 0.46 | |
| Sb2O3 | 0.02 | 0.00 | 0.00 | 0.03 | 0.11 | 0.03 | 0.00 | 0.05 | | 0.00 | |
| Bi2O3 | 0.02 | | | | | | | | | | |
| Total | 99.49 | 97.81 | 96.74 | 98.28 | 96.91 | 98.59 | 99.35 | 99.32 | 97.82 | 100.03 | 99.27 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | |
| Li | 0.000 | 0.005 | 0.028 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.101 |
| Fe2+ | 0.970 | 3.183 | 3.183 | 2.979 | 2.864 | 2.486 | 2.593 | 2.534 | 3.126 | 3.408 | 2.606 |
| Mn | 3.201 | 0.793 | 0.764 | 1.146 | 1.154 | 1.512 | 1.410 | 1.447 | 0.882 | 0.695 | 1.288 |
| Fe3+ | 0.722 | 0.831 | 0.853 | 0.547 | 0.598 | 0.715 | 0.715 | 0.712 | 0.578 | 0.560 | 0.760 |
| Ti | 0.482 | 0.298 | 0.285 | 1.228 | 0.936 | 0.405 | 0.430 | 0.421 | 1.408 | 1.196 | 0.757 |
| Nb | 1.679 | 1.856 | 1.953 | 2.630 | 2.403 | 1.959 | 1.913 | 1.941 | 2.542 | 3.064 | 2.472 |
| Ta | 6.602 | 6.530 | 6.507 | 5.785 | 6.140 | 6.707 | 6.747 | 6.747 | 5.906 | 5.438 | 6.037 |
| Sn | 2.446 | 1.914 | 1.839 | 1.629 | 1.729 | 2.114 | 2.105 | 2.081 | 1.563 | 1.589 | 1.791 |
| W | 0.054 | 0.331 | 0.321 | 0.009 | 0.061 | 0.040 | 0.039 | 0.038 | 0.002 | 0.000 | 0.183 |
| Pb | 0.002 | 0.019 | 0.025 | 0.011 | 0.008 | 0.013 | 0.008 | 0.017 | 0.055 | 0.003 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| U | 0.002 | 0.032 | 0.033 | 0.012 | 0.015 | 0.008 | 0.005 | 0.011 | 0.000 | 0.000 | 0.000 |
| Sc | 0.007 | 0.207 | 0.209 | 0.151 | 0.100 | 0.047 | 0.047 | 0.039 | | 0.153 | 0.000 |
| Sb | 0.003 | 0.000 | 0.000 | 0.005 | 0.018 | 0.005 | 0.000 | 0.008 | | 0.000 | 0.000 |
| Bi | 0.002 | | | | | | | | | | |
| Total | 16.173 | 16.000 | 16.000 | 16.135 | 16.026 | 16.011 | 16.012 | 16.000 | 16.063 | 16.106 | 16.000 |
| Comments: | | YD & YE same grain | | RH & RI same grain inclusion in large euhedral cass. | | PF - PO same grain some microlite alteration | | | inclusion in large euhedral cassiterite | | |
| | wodginite | ferrowodginite | | ferrowodginite | | ferrowodginite | | | ferrowodginite | | |

| | | | James' pegmatite | | | | SW Beryl pegmatite | | | | Marko's pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 93-276B | | | | 94-15A | | | | 94-44A | | |
| Raw data | PC | PS | PU | PV | SO | FC | FK | FL | VA | VC | VF | VG | VH |
| FeO | 10.29 | 10.37 | 10.39 | 10.33 | 9.94 | 10.33 | 9.74 | 10.12 | 2.11 | 2.19 | 2.14 | 2.19 | 2.15 |
| MnO | 3.54 | 3.62 | 3.79 | 3.79 | 4.43 | 4.13 | 4.14 | 3.97 | 10.24 | 10.38 | 10.57 | 10.43 | 10.35 |
| TiO2 | 2.85 | 3.50 | 2.84 | 3.08 | 2.94 | 2.53 | 2.81 | 1.87 | 1.41 | 1.53 | 1.43 | 1.20 | 1.44 |
| Nb2O5 | 12.33 | 12.60 | 13.32 | 12.74 | 14.28 | 13.36 | 12.73 | 12.29 | 7.90 | 8.47 | 8.09 | 6.90 | 8.14 |
| Ta2O5 | 57.56 | 57.13 | 57.30 | 56.50 | 54.84 | 54.32 | 55.81 | 55.12 | 60.57 | 60.60 | 59.65 | 61.43 | 61.68 |
| SnO2 | 11.28 | 10.53 | 11.13 | 10.75 | 10.49 | 11.74 | 11.66 | 12.17 | 14.97 | 15.04 | 15.03 | 14.99 | 14.95 |
| WO3 | 1.65 | 1.65 | 1.57 | 1.72 | 1.56 | 2.45 | 1.72 | 2.53 | 0.33 | 0.14 | 0.26 | 0.25 | 0.17 |
| PbO | 0.06 | 0.00 | 0.00 | 0.00 | 0.03 | 0.15 | 0.12 | 0.18 | 0.05 | 0.00 | 0.02 | 0.02 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00. | 0.00 | 0.00 | 0.20 | 0.11 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | 0.23 | 0.19 | 0.23 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Sb2O3 | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | 0.00 | 0.00 | 0.00 | | | | | |
| Total | 99.55 | 99.39 | 100.32 | 98.89 | 98.51 | 99.44 | 99.03 | 98.62 | 97.58 | 98.37 | 97.19 | 97.40 | 98.89 |
| Recalculated | | | 93-276B | | | | 94-15A | | | | 94-44A | | |
| oxides | PC | PS | PU | PV | SO | FC | FK | FL | VA | VC | VF | VG | VH |
| Li2O | 0.05 | 0.03 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.00 | 0.04 |
| FeO | 8.12 | 8.23 | 8.09 | 8.04 | 7.50 | 7.95 | 7.71 | 7.75 | 0.73 | 0.81 | 0.64 | 0.65 | 0.75 |
| MnO | 3.54 | 3.62 | 3.79 | 3.79 | 4.43 | 4.13 | 4.14 | 3.97 | 10.24 | 10.38 | 10.57 | 10.43 | 10.35 |
| Fe2O3 | 2.38 | 2.35 | 2.52 | 2.50 | 2.68 | 2.61 | 2.22 | 2.59 | 1.53 | 1.53 | 1.67 | 1.70 | 1.55 |
| TiO2 | 2.85 | 3.50 | 2.84 | 3.08 | 2.94 | 2.53 | 2.81 | 1.87 | 1.41 | 1.53 | 1.43 | 1.20 | 1.44 |
| Nb2O5 | 12.33 | 12.60 | 13.32 | 12.74 | 14.28 | 13.36 | 12.73 | 12.29 | 7.90 | 8.47 | 8.09 | 6.90 | 8.14 |
| Ta2O5 | 57.56 | 57.13 | 57.30 | 56.50 | 54.84 | 54.32 | 55.81 | 55.12 | 60.57 | 60.60 | 59.65 | 61.43 | 61.68 |
| SnO2 | 11.28 | 10.53 | 11.13 | 10.75 | 10.49 | 11.74 | 11.66 | 12.17 | 14.97 | 15.04 | 15.03 | 14.99 | 14.95 |
| WO3 | 1.65 | 1.65 | 1.57 | 1.72 | 1.56 | 2.45 | 1.72 | 2.53 | 0.33 | 0.14 | 0.26 | 0.25 | 0.17 |
| PbO | 0.06 | 0.00 | 0.00 | 0.00 | 0.03 | 0.15 | 0.12 | 0.18 | 0.05 | 0.00 | 0.02 | 0.02 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.20 | 0.11 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | 0.23 | 0.19 | 0.23 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 |
| Sb2O3 | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | 0.00 | 0.00 | 0.00 | | | | | |
| Total | 99.81 | 99.63 | 100.58 | 99.13 | 98.76 | 99.66 | 99.22 | 98.84 | 97.79 | 98.55 | 97.38 | 97.59 | 99.11 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.080 | 0.048 | 0.067 | 0.027 | 0.006 | 0.000 | 0.000 | 0.000 | 0.060 | 0.035 | 0.000 | 0.000 | 0.076 |
| Fe2+ | 2.717 | 2.736 | 2.671 | 2.693 | 2.499 | 2.646 | 2.589 | 2.633 | 0.260 | 0.284 | 0.226 | 0.234 | 0.263 |
| Mn | 1.197 | 1.216 | 1.262 | 1.280 | 1.491 | 1.388 | 1.402 | 1.361 | 3.674 | 3.681 | 3.798 | 3.777 | 3.661 |
| Fe3+ | 0.716 | 0.703 | 0.748 | 0.754 | 0.805 | 0.781 | 0.669 | 0.792 | 0.488 | 0.482 | 0.533 | 0.549 | 0.488 |
| Ti | 0.854 | 1.042 | 0.839 | 0.925 | 0.879 | 0.755 | 0.845 | 0.569 | 0.449 | 0.482 | 0.456 | 0.386 | 0.452 |
| Nb | 2.223 | 2.259 | 2.371 | 2.299 | 2.566 | 2.396 | 2.302 | 2.249 | 1.514 | 1.602 | 1.552 | 1.333 | 1.538 |
| Ta | 6.243 | 6.162 | 6.135 | 6.134 | 5.927 | 5.861 | 6.070 | 6.067 | 6.977 | 6.899 | 6.881 | 7.142 | 7.006 |
| Sn | 1.794 | 1.664 | 1.746 | 1.711 | 1.662 | 1.857 | 1.860 | 1.964 | 2.529 | 2.511 | 2.542 | 2.555 | 2.490 |
| W | 0.171 | 0.170 | 0.160 | 0.178 | 0.161 | 0.252 | 0.178 | 0.265 | 0.036 | 0.015 | 0.029 | 0.028 | 0.018 |
| Pb | 0.006 | 0.000 | 0.000 | 0.000 | 0.003 | 0.016 | 0.013 | 0.020 | 0.006 | 0.000 | 0.002 | 0.002 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.018 | 0.010 | 0.013 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | | | | | | 0.080 | 0.066 | 0.081 | 0.007 | 0.007 | 0.007 | 0.007 | 0.007 |
| Sb | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.050 | 16.004 | 16.014 | 16.000 | 16.000 | 16.026 | 16.013 | 16.000 |
| Comments: | | | PA - PV same grain<br>BSE image shows very complex<br>zoning of this crystal<br>this was the first grain found in Ontario<br>ferrowodginite | | | | FC - FL same grain<br>grain is part wodginite<br>and part cassiterite<br>ferrowodginite | | | | VA - VN same grain<br>complex crystal - part wodginite/part<br>microlite/part columbite<br>wodginite | | |

|  | Marko's pegmatite |  |  |  | Marko's | Marko's pegmatite |  |  |  |  | Marko's peg. |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-44A |  |  |  | 94-44C | 94-44D |  |  |  |  | 94-44E |  |
| Raw data | VJ | VL | VM | VN | YF | DB | JB | JC | JD | JG | KA | KB |
| FeO | 2.31 | 2.19 | 2.36 | 2.31 | 2.36 | 2.38 | 2.43 | 2.33 | 2.30 | 2.25 | 2.26 | 2.25 |
| MnO | 10.12 | 10.12 | 10.10 | 10.18 | 10.01 | 10.70 | 9.53 | 9.95 | 9.90 | 9.44 | 10.04 | 10.38 |
| TiO2 | 1.24 | 1.38 | 1.02 | 1.13 | 0.84 | 1.14 | 0.79 | 1.00 | 1.09 | 1.00 | 1.43 | 1.28 |
| Nb2O5 | 6.95 | 7.31 | 6.69 | 6.72 | 5.72 | 5.73 | 6.30 | 6.26 | 5.71 | 5.87 | 4.69 | 4.94 |
| Ta2O5 | 63.06 | 61.12 | 61.64 | 62.07 | 62.41 | 63.16 | 64.34 | 65.01 | 65.34 | 65.40 | 66.02 | 65.52 |
| SnO2 | 15.02 | 15.20 | 15.98 | 15.20 | 16.37 | 15.15 | 14.98 | 14.04 | 13.99 | 14.95 | 14.41 | 14.22 |
| WO3 | 0.22 | 0.33 | 0.26 | 0.22 | 0.16 | 0.18 | 0.18 | 0.26 | 0.33 | 0.28 | 0.21 | 0.22 |
| PbO | 0.03 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 | 0.05 | 0.03 | 0.02 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.03 | 0.05 | 0.03 |  | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 |  | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |
| Bi2O3 |  |  |  |  |  | 0.00 | 0.00 | 0.03 | 0.03 | 0.03 |  |  |
| Total | 98.95 | 97.67 | 98.07 | 97.86 | 97.89 | 98.46 | 98.65 | 98.94 | 98.76 | 99.28 | 99.09 | 98.81 |
| Recalculated | 94-44A |  |  |  | 94-44C | 94-44D |  |  |  |  | 94-44E |  |
| oxides | VJ | VL | VM | VN | YF | DB | JB | JC | JD | JG | KA | KB |
| Li2O | 0.04 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.11 | 0.10 | 0.10 | 0.15 | 0.05 | 0.01 |
| FeO | 0.88 | 0.86 | 1.01 | 0.85 | 1.01 | 0.65 | 1.01 | 0.71 | 0.72 | 0.98 | 0.82 | 0.62 |
| MnO | 10.12 | 10.12 | 10.10 | 10.18 | 10.01 | 10.70 | 9.53 | 9.95 | 9.90 | 9.44 | 10.04 | 10.38 |
| Fe2O3 | 1.58 | 1.47 | 1.50 | 1.61 | 1.49 | 1.92 | 1.57 | 1.79 | 1.74 | 1.41 | 1.59 | 1.81 |
| TiO2 | 1.24 | 1.38 | 1.02 | 1.13 | 0.84 | 1.14 | 0.79 | 1.00 | 1.09 | 1.00 | 1.43 | 1.28 |
| Nb2O5 | 6.95 | 7.31 | 6.69 | 6.72 | 5.72 | 5.73 | 6.30 | 6.26 | 5.71 | 5.87 | 4.69 | 4.94 |
| Ta2O5 | 63.06 | 61.12 | 61.64 | 62.07 | 62.41 | 63.16 | 64.34 | 65.01 | 65.34 | 65.40 | 66.02 | 65.52 |
| SnO2 | 15.02 | 15.20 | 15.98 | 15.20 | 16.37 | 15.15 | 14.98 | 14.04 | 13.99 | 14.95 | 14.41 | 14.22 |
| WO3 | 0.22 | 0.33 | 0.26 | 0.22 | 0.16 | 0.18 | 0.18 | 0.26 | 0.33 | 0.28 | 0.21 | 0.22 |
| PbO | 0.03 | 0.02 | 0.02 | 0.03 | 0.02 | 0.02 | 0.05 | 0.05 | 0.05 | 0.03 | 0.02 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.03 | 0.05 | 0.03 |  | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 |  | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |
| Bi2O3 |  |  |  |  |  | 0.00 | 0.00 | 0.03 | 0.03 | 0.03 |  |  |
| Total | 99.18 | 97.87 | 98.26 | 98.06 | 98.04 | 98.70 | 98.91 | 99.21 | 99.02 | 99.56 | 99.29 | 99.00 |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.074 | 0.049 | 0.000 | 0.012 | 0.000 | 0.000 | 0.192 | 0.166 | 0.164 | 0.259 | 0.080 | 0.024 |
| Fe2+ | 0.312 | 0.307 | 0.360 | 0.306 | 0.365 | 0.230 | 0.362 | 0.253 | 0.258 | 0.347 | 0.293 | 0.222 |
| Mn | 3.611 | 3.642 | 3.645 | 3.679 | 3.649 | 3.857 | 3.440 | 3.575 | 3.573 | 3.390 | 3.624 | 3.754 |
| Fe3+ | 0.502 | 0.471 | 0.481 | 0.519 | 0.484 | 0.617 | 0.505 | 0.573 | 0.562 | 0.450 | 0.513 | 0.581 |
| Ti | 0.393 | 0.441 | 0.327 | 0.363 | 0.272 | 0.365 | 0.253 | 0.319 | 0.349 | 0.319 | 0.458 | 0.411 |
| Nb | 1.323 | 1.404 | 1.288 | 1.296 | 1.113 | 1.103 | 1.214 | 1.201 | 1.100 | 1.125 | 0.904 | 0.954 |
| Ta | 7.225 | 7.061 | 7.142 | 7.202 | 7.304 | 7.310 | 7.458 | 7.500 | 7.571 | 7.541 | 7.652 | 7.608 |
| Sn | 2.523 | 2.575 | 2.715 | 2.586 | 2.809 | 2.571 | 2.546 | 2.375 | 2.377 | 2.528 | 2.449 | 2.421 |
| W | 0.024 | 0.036 | 0.029 | 0.024 | 0.018 | 0.020 | 0.020 | 0.029 | 0.036 | 0.031 | 0.023 | 0.024 |
| Pb | 0.003 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.006 | 0.006 | 0.006 | 0.003 | 0.002 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 |
| Sc | 0.011 | 0.011 | 0.019 | 0.011 | 0.000 | 0.011 | 0.000 | 0.000 | 0.000 | 0.000 |  |  |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 |  |  |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.003 | 0.003 |  |  |
| Total | 16.000 | 16.000 | 16.007 | 16.000 | 16.016 | 16.090 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: |  |  |  |  | inclusion in cass. |  | JB & JC rimmed with microlite |  |  |  | KA & KB same grain from aplite |  |
|  |  | wodginite |  |  | Fe wodginite |  |  | wodginite |  |  | wodginite |  |

| | **Marko's peg.** | | | | | | | **Marko's pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44E | | | | | | | 94-44I | | | | | |
| **Raw data** | KH | KK | #1 | #2 | #3 | #4 | QG | QI | QK | QL | QN | SY | SZ |
| FeO | 2.46 | 2.37 | 8.41 | 7.42 | 7.16 | 6.74 | 5.91 | 8.49 | 7.54 | 9.02 | 4.92 | 9.18 | 8.93 |
| MnO | 9.97 | 10.23 | 4.44 | 4.80 | 5.15 | 5.38 | 6.96 | 4.94 | 5.09 | 4.47 | 7.24 | 4.03 | 4.00 |
| TiO2 | 1.19 | 1.16 | 6.85 | 5.63 | 7.04 | 4.31 | 5.02 | 7.90 | 6.33 | 6.42 | 1.67 | 6.74 | 4.86 |
| Nb2O5 | 6.08 | 6.62 | 12.20 | 7.95 | 8.37 | 6.05 | 7.54 | 11.11 | 9.36 | 12.10 | 1.57 | 9.23 | 5.15 |
| Ta2O5 | 64.04 | 64.10 | 57.80 | 61.83 | 60.95 | 64.32 | 62.08 | 57.82 | 56.63 | 57.35 | 68.06 | 60.18 | 64.44 |
| SnO2 | 14.56 | 15.00 | 9.44 | 10.10 | 9.06 | 11.91 | 11.02 | 8.47 | 13.38 | 9.00 | 14.48 | 9.19 | 11.03 |
| WO3 | 0.29 | 0.20 | 0.72 | 0.67 | 0.64 | 0.44 | 0.65 | 0.49 | 0.55 | 0.41 | 0.45 | 0.31 | 0.42 |
| PbO | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.03 | 0.02 | 0.07 | 0.05 | 0.02 | 0.05 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.09 |
| Sc2O3 | | | 0.36 | 0.06 | 0.14 | 0.17 | | | | | | 0.08 | 0.05 |
| Sb2O3 | | | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | 0.00 | 0.00 |
| Bi2O3 | | | 0.00 | 0.03 | 0.00 | 0.00 | | | | | | 0.02 | 0.05 |
| Total | 98.61 | 99.68 | 100.21 | 98.49 | 98.56 | 99.33 | 99.21 | 99.24 | 98.95 | 98.83 | 98.41 | 99.09 | 98.97 |
| **Recalculated** | 94-44E | | | | | | | 94-44i | | | | | |
| **oxides** | KH | KK | #1 | #2 | #3 | #4 | QG | QI | QK | QL | QN | SY | SZ |
| Li2O | 0.05 | 0.04 | 0.01 | 0.07 | 0.02 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.92 | 0.84 | 7.81 | 6.59 | 6.61 | 5.93 | 4.76 | 7.57 | 7.16 | 7.77 | 3.59 | 8.19 | 7.73 |
| MnO | 9.97 | 10.23 | 4.44 | 4.80 | 5.15 | 5.38 | 6.96 | 4.940 | 5.090 | 4.470 | 7.24 | 4.03 | 4.00 |
| Fe2O3 | 1.70 | 1.69 | 0.63 | 0.90 | 0.60 | 0.88 | 1.27 | 1.018 | 0.417 | 1.381 | 1.47 | 1.08 | 1.32 |
| TiO2 | 1.19 | 1.16 | 6.85 | 5.63 | 7.04 | 4.31 | 5.02 | 7.90 | 6.33 | 6.42 | 1.67 | 6.74 | 4.86 |
| Nb2O5 | 6.08 | 6.62 | 12.20 | 7.95 | 8.37 | 6.05 | 7.54 | 11.11 | 9.36 | 12.10 | 1.57 | 9.23 | 5.15 |
| Ta2O5 | 64.04 | 64.10 | 57.80 | 61.83 | 60.95 | 64.32 | 62.08 | 57.82 | 56.63 | 57.35 | 68.06 | 60.18 | 64.44 |
| SnO2 | 14.56 | 15.00 | 9.44 | 10.10 | 9.06 | 11.91 | 11.02 | 8.47 | 13.38 | 9.00 | 14.48 | 9.19 | 11.03 |
| WO3 | 0.29 | 0.20 | 0.72 | 0.67 | 0.64 | 0.44 | 0.65 | 0.49 | 0.55 | 0.41 | 0.45 | 0.31 | 0.42 |
| PbO | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.03 | 0.02 | 0.07 | 0.05 | 0.02 | 0.05 | 0.05 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.09 |
| Sc2O3 | | | 0.36 | 0.06 | 0.14 | 0.17 | | | | | | 0.08 | 0.05 |
| Sb2O3 | | | 0.00 | 0.00 | 0.00 | 0.00 | | | | | | 0.00 | 0.00 |
| Bi2O3 | | | 0.00 | 0.03 | 0.00 | 0.00 | | | | | | 0.02 | 0.05 |
| Total | 98.82 | 99.88 | 100.26 | 98.62 | 98.63 | 99.44 | 99.34 | 99.33 | 98.99 | 98.96 | 98.55 | 99.28 | 99.19 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.080 | 0.068 | 0.021 | 0.107 | 0.035 | 0.077 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 |
| Fe2+ | 0.328 | 0.297 | 2.528 | 2.242 | 2.214 | 2.047 | 1.617 | 2.455 | 2.382 | 2.548 | 1.312 | 2.718 | 2.672 |
| Mn | 3.590 | 3.635 | 1.451 | 1.651 | 1.746 | 1.875 | 2.391 | 1.622 | 1.714 | 1.483 | 2.678 | 1.353 | 1.398 |
| Fe3+ | 0.547 | 0.535 | 0.182 | 0.276 | 0.181 | 0.275 | 0.388 | 0.297 | 0.125 | 0.408 | 0.485 | 0.324 | 0.409 |
| Ti | 0.380 | 0.366 | 1.987 | 1.716 | 2.117 | 1.336 | 1.531 | 2.303 | 1.893 | 1.891 | 0.549 | 2.008 | 1.508 |
| Nb | 1.169 | 1.256 | 2.127 | 1.457 | 1.513 | 1.127 | 1.383 | 1.947 | 1.682 | 2.143 | 0.310 | 1.653 | 0.961 |
| Ta | 7.404 | 7.313 | 6.060 | 6.821 | 6.628 | 7.201 | 6.848 | 6.095 | 6.123 | 6.110 | 8.084 | 6.485 | 7.231 |
| Sn | 2.468 | 2.509 | 1.451 | 1.634 | 1.444 | 1.955 | 1.782 | 1.309 | 2.121 | 1.406 | 2.522 | 1.452 | 1.815 |
| W | 0.032 | 0.022 | 0.072 | 0.071 | 0.067 | 0.047 | 0.068 | 0.049 | 0.057 | 0.042 | 0.051 | 0.032 | 0.045 |
| Pb | 0.002 | 0.000 | 0.000 | 0.000 | 0.005 | 0.001 | 0.003 | 0.002 | 0.007 | 0.005 | 0.002 | 0.005 | 0.006 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.015 | 0.008 |
| Sc | | | 0.121 | 0.022 | 0.050 | 0.060 | | | | | | 0:028 | 0.018 |
| Sb | | | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | 0.000 | 0.000 |
| Bi | | | 0.000 | 0.003 | 0.000 | 0.000 | | | | | | 0.002 | 0.005 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.011 | 16.079 | 16.103 | 16.036 | 16.000 | 16.076 | 16.076 |
| Comments: | partially replaced<br>by microlite<br>close to aplite | | | | | | | all data from single grain with patchy zonation<br>FeTi wodginite occurs at margin | | | | | |
| | | | FeTi wodg. | | FeTi wodg. | | wodg. | | Fe wodg. | | wodg. | | Fe wodg. |
| | wodginite | | | Fe wodg. | | Fe wodg. | | FeTi wodg. | | FeTi wodg. | | FeTi wodg. | |

**Marko's pegmatite**

94-44I

| Raw data | TB | TC | TQZ | TQL | TSF | TQA | TQB | TSG | TQC | TSH | TSJ | TQE | TSK | TSL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 4.66 | 4.73 | 9.05 | 8.44 | 8.59 | 8.57 | 7.46 | 7.27 | 6.87 | 5.11 | 3.62 | 1.66 | 3.98 | 3.34 |
| MnO | 8.14 | 8.53 | 4.24 | 4.74 | 4.52 | 4.73 | 5.56 | 5.94 | 6.02 | 7.30 | 8.65 | 10.58 | 8.23 | 8.79 |
| TiO2 | 4.43 | 4.43 | 6.11 | 4.93 | 5.42 | 6.43 | 4.81 | 5.53 | 4.51 | 2.84 | 2.60 | 0.53 | 1.72 | 2.36 |
| Nb2O5 | 6.26 | 7.01 | 9.77 | 8.12 | 9.19 | 9.98 | 7.89 | 9.27 | 7.23 | 4.60 | 4.10 | 3.32 | 2.47 | 2.19 |
| Ta2O5 | 62.34 | 63.15 | 60.74 | 61.54 | 61.01 | 59.44 | 62.25 | 60.47 | 62.60 | 64.91 | 65.05 | 65.95 | 67.05 | 67.78 |
| SnO2 | 11.80 | 11.23 | 9.80 | 11.01 | 10.43 | 9.64 | 11.22 | 10.30 | 11.51 | 13.29 | 14.17 | 15.46 | 14.37 | 13.83 |
| WO3 | 0.53 | 0.59 | 0.55 | 0.47 | 0.51 | 0.43 | 0.60 | 0.55 | 0.46 | 0.44 | 0.57 | 1.02 | 0.54 | 0.69 |
| PbO | 0.07 | 0.02 | 0.12 | 0.08 | 0.08 | 0.08 | 0.10 | 0.07 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| UO2 | 0.09 | 0.00 | 0.08 | 0.12 | 0.12 | 0.09 | 0.08 | 0.06 | 0.09 | 0.06 | 0.03 | 0.03 | 0.02 | 0.00 |
| Sc2O3 | 0.05 | 0.02 | 0.06 | 0.03 | 0.03 | 0.08 | 0.03 | 0.06 | 0.03 | 0.05 | 0.02 | 0.03 | 0.03 | 0.03 |
| Sb2O3 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.09 | 0.02 |
| Total | 98.33 | 99.70 | 100.46 | 99.45 | 99.87 | 99.39 | 99.97 | 99.46 | 99.31 | 98.57 | 98.81 | 98.55 | 98.41 | 98.98 |

94-44i

| Recalculated oxides | TB | TC | TQZ | TQL | TSF | TQA | TQB | TSG | TQC | TSH | TSJ | TQE | TSK | TSL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.02 |
| FeO | 3.48 | 3.29 | 7.93 | 7.17 | 7.44 | 7.52 | 6.26 | 6.08 | 5.68 | 3.89 | 2.48 | 0.08 | 2.66 | 2.12 |
| MnO | 8.14 | 8.53 | 4.24 | 4.74 | 4.52 | 4.73 | 5.56 | 5.94 | 6.02 | 7.30 | 8.65 | 10.58 | 8.23 | 8.79 |
| Fe2O3 | 1.30 | 1.60 | 1.22 | 1.39 | 1.27 | 1.16 | 1.33 | 1.31 | 1.31 | 1.34 | 1.26 | 1.75 | 1.46 | 1.34 |
| TiO2 | 4.43 | 4.43 | 6.11 | 4.93 | 5.42 | 6.43 | 4.81 | 5.53 | 4.51 | 2.84 | 2.60 | 0.53 | 1.72 | 2.36 |
| Nb2O5 | 6.26 | 7.01 | 9.77 | 8.12 | 9.19 | 9.98 | 7.89 | 9.27 | 7.23 | 4.60 | 4.10 | 3.32 | 2.47 | 2.19 |
| Ta2O5 | 62.34 | 63.15 | 60.74 | 61.54 | 61.01 | 59.44 | 62.25 | 60.47 | 62.60 | 64.91 | 65.05 | 65.95 | 67.05 | 67.78 |
| SnO2 | 11.80 | 11.23 | 9.80 | 11.01 | 10.43 | 9.64 | 11.22 | 10.30 | 11.51 | 13.29 | 14.17 | 15.46 | 14.37 | 13.83 |
| WO3 | 0.53 | 0.59 | 0.55 | 0.47 | 0.51 | 0.43 | 0.60 | 0.55 | 0.46 | 0.44 | 0.57 | 1.02 | 0.54 | 0.69 |
| PbO | 0.07 | 0.02 | 0.12 | 0.08 | 0.08 | 0.08 | 0.10 | 0.07 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| UO2 | 0.09 | 0.00 | 0.08 | 0.12 | 0.12 | 0.09 | 0.08 | 0.06 | 0.09 | 0.06 | 0.03 | 0.03 | 0.02 | 0.00 |
| Sc2O3 | 0.05 | 0.02 | 0.06 | 0.03 | 0.03 | 0.08 | 0.03 | 0.06 | 0.03 | 0.05 | 0.02 | 0.03 | 0.03 | 0.03 |
| Sb2O3 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.09 | 0.02 |
| Total | 98.52 | 99.89 | 100.65 | 99.63 | 100.04 | 99.61 | 100.14 | 99.68 | 99.46 | 98.75 | 98.97 | 98.79 | 98.67 | 99.19 |

**Structural formulae based on 32 oxygens**

| | TB | TC | TQZ | TQL | TSF | TQA | TQB | TSG | TQC | TSH | TSJ | TQE | TSK | TSL |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.078 | 0.010 | 0.038 |
| Fe2+ | 1.206 | 1.118 | 2.608 | 2.424 | 2.480 | 2.482 | 2.110 | 2.029 | 1.940 | 1.380 | 0.883 | 0.029 | 0.967 | 0.764 |
| Mn | 2.852 | 2.935 | 1.409 | 1.620 | 1.525 | 1.579 | 1.897 | 2.005 | 2.079 | 2.617 | 3.110 | 3.894 | 3.023 | 3.198 |
| Fe3+ | 0.406 | 0.489 | 0.362 | 0.424 | 0.381 | 0.344 | 0.402 | 0.394 | 0.403 | 0.429 | 0.402 | 0.575 | 0.477 | 0.435 |
| Ti | 1.378 | 1.353 | 1.803 | 1.496 | 1.623 | 1.906 | 1.457 | 1.657 | 1.383 | 0.904 | 0.830 | 0.173 | 0.561 | 0.762 |
| Nb | 1.171 | 1.288 | 1.733 | 1.481 | 1.655 | 1.779 | 1.437 | 1.670 | 1.333 | 0.880 | 0.787 | 0.652 | 0.484 | 0.425 |
| Ta | 7.012 | 6.977 | 6.482 | 6.753 | 6.608 | 6.372 | 6.818 | 6.554 | 6.942 | 7.472 | 7.508 | 7.792 | 7.907 | 7.917 |
| Sn | 1.946 | 1.819 | 1.533 | 1.772 | 1.656 | 1.515 | 1.802 | 1.637 | 1.872 | 2.243 | 2.398 | 2.678 | 2.485 | 2.369 |
| W | 0.057 | 0.062 | 0.056 | 0.049 | 0.053 | 0.044 | 0.063 | 0.057 | 0.049 | 0.048 | 0.063 | 0.115 | 0.061 | 0.077 |
| Pb | 0.008 | 0.002 | 0.013 | 0.009 | 0.009 | 0.008 | 0.011 | 0.008 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 |
| Th | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 |
| U | 0.008 | 0.000 | 0.007 | 0.011 | 0.011 | 0.008 | 0.007 | 0.005 | 0.008 | 0.006 | 0.003 | 0.003 | 0.002 | 0.000 |
| Sc | 0.018 | 0.007 | 0.021 | 0.011 | 0.010 | 0.027 | 0.011 | 0.021 | 0.011 | 0.018 | 0.007 | 0.011 | 0.011 | 0.011 |
| Sb | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.010 | 0.002 |
| Total | 16.066 | 16.056 | 16.030 | 16.053 | 16.014 | 16.069 | 16.018 | 16.042 | 16.021 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | | | | | | | all data from single grain with patchy zonation<br>FeTi wodginite occurs at margin | | | | | | core of crystal | |
| | wodg. | wodg. | Fe wodg. | Fe wodg. | Fe wodg. | FeTi wodg. | Fe wodg. | Fe wodg. | wodg. | wodg. | wodg. | wodg. | wodg. | wodg. |

| | | | | | **Marko's pegmatite** | | | | | | **Marko's pegmatite** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 94-44I | | | | | | 94-44J | | |
| **Raw data** | TQF | TSM | TQP | TQS | TQT | TQU | TSU | TSV | TQW | SK | ZI | ZJ | ZK |
| FeO | 3.26 | 3.50 | 4.27 | 7.56 | 7.01 | 7.70 | 6.96 | 8.58 | 10.07 | 7.78 | 8.40 | 7.63 | 8.52 |
| MnO | 8.76 | 8.83 | 8.18 | 5.41 | 5.78 | 5.50 | 5.90 | 4.77 | 3.90 | 5.61 | 5.22 | 6.69 | 5.66 |
| TiO2 | 2.14 | 2.09 | 3.37 | 6.27 | 6.66 | 7.73 | 5.68 | 7.57 | 8.14 | 8.27 | 8.11 | 8.21 | 9.01 |
| Nb2O5 | 2.01 | 2.05 | 3.30 | 8.55 | 7.05 | 9.81 | 6.52 | 12.94 | 15.74 | 10.30 | 13.55 | 13.85 | 13.75 |
| Ta2O5 | 67.38 | 67.72 | 65.86 | 60.73 | 62.18 | 58.69 | 62.76 | 55.99 | 53.29 | 59.92 | 52.46 | 53.57 | 55.49 |
| SnO2 | 13.85 | 13.39 | 12.84 | 9.40 | 9.12 | 8.71 | 10.27 | 8.65 | 8.30 | 8.39 | 11.13 | 8.49 | 8.13 |
| WO3 | 0.65 | 0.50 | 0.57 | 0.45 | 0.48 | 0.37 | 0.75 | 0.46 | 0.34 | 0.00 | 0.12 | 0.04 | 0.11 |
| PbO | 0.00 | 0.00 | 0.02 | 0.03 | 0.03 | 0.03 | 0.00 | 0.08 | 0.11 | 0.03 | 0.05 | 0.08 | 0.05 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.03 |
| UO2 | 0.05 | 0.05 | 0.12 | 0.05 | 0.08 | 0.06 | 0.06 | 0.12 | 0.23 | 0.00 | 0.00 | 0.08 | 0.00 |
| Sc2O3 | 0.03 | 0.03 | 0.05 | 0.06 | 0.06 | 0.06 | 0.03 | 0.06 | 0.05 | | | | |
| Sb2O3 | 0.10 | 0.00 | 0.39 | 0.05 | 0.05 | 0.02 | 0.02 | 0.03 | 0.05 | | | | |
| Bi2O3 | 0.02 | 0.05 | 0.05 | 0.03 | 0.02 | 0.03 | 0.00 | 0.00 | 0.02 | | | | |
| Total | 98.11 | 98.13 | 98.53 | 98.45 | 98.39 | 98.64 | 98.90 | 99.16 | 100.12 | 100.30 | 99.05 | 98.66 | 100.75 |
| **Recalculated** | | | | | 94-44i | | | | | | | | |
| **oxides** | TQF | TSM | TQP | TQS | TQT | TQU | TSU | TSV | TQW | SK | ZI | ZJ | ZK |
| Li2O | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 2.06 | 2.08 | 3.19 | 6.55 | 6.12 | 6.89 | 5.89 | 7.70 | 9.08 | 7.00 | 7.82 | 6.40 | 7.57 |
| MnO | 8.76 | 8.83 | 8.18 | 5.41 | 5.78 | 5.50 | 5.90 | 4.77 | 3.90 | 5.61 | 5.22 | 6.69 | 5.66 |
| Fe2O3 | 1.33 | 1.57 | 1.19 | 1.11 | 0.97 | 0.89 | 1.18 | 0.97 | 1.09 | 0.86 | 0.64 | 1.36 | 1.05 |
| TiO2 | 2.14 | 2.09 | 3.37 | 6.27 | 6.66 | 7.73 | 5.68 | 7.57 | 8.14 | 8.27 | 8.11 | 8.21 | 9.01 |
| Nb2O5 | 2.01 | 2.05 | 3.30 | 8.55 | 7.05 | 9.81 | 6.52 | 12.94 | 15.74 | 10.30 | 13.55 | 13.85 | 13.75 |
| Ta2O5 | 67.38 | 67.72 | 65.86 | 60.73 | 62.18 | 58.69 | 62.76 | 55.99 | 53.29 | 59.92 | 52.46 | 53.57 | 55.49 |
| SnO2 | 13.85 | 13.39 | 12.84 | 9.40 | 9.12 | 8.71 | 10.27 | 8.65 | 8.30 | 8.39 | 11.13 | 8.49 | 8.13 |
| WO3 | 0.65 | 0.50 | 0.57 | 0.45 | 0.48 | 0.37 | 0.75 | 0.46 | 0.34 | 0.00 | 0.12 | 0.04 | 0.11 |
| PbO | 0.00 | 0.00 | 0.02 | 0.03 | 0.03 | 0.03 | 0.00 | 0.08 | 0.11 | 0.03 | 0.05 | 0.08 | 0.05 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.03 |
| UO2 | 0.05 | 0.05 | 0.12 | 0.05 | 0.08 | 0.06 | 0.06 | 0.12 | 0.23 | 0.00 | 0.00 | 0.08 | 0.00 |
| Sc2O3 | 0.03 | 0.03 | 0.05 | 0.06 | 0.06 | 0.06 | 0.03 | 0.06 | 0.05 | | | | |
| Sb2O3 | 0.10 | 0.00 | 0.39 | 0.05 | 0.05 | 0.02 | 0.02 | 0.03 | 0.05 | | | | |
| Bi2O3 | 0.02 | 0.05 | 0.05 | 0.03 | 0.02 | 0.03 | 0.00 | 0.00 | 0.02 | | | | |
| Total | 98.40 | 98.36 | 99.13 | 98.69 | 98.61 | 98.83 | 99.06 | 99.34 | 100.34 | 100.38 | 99.11 | 98.79 | 100.85 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.028 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe2+ | 0.749 | 0.758 | 1.132 | 2.203 | 2.072 | 2.267 | 2.007 | 2.484 | 2.844 | 2.257 | 2.497 | 2.046 | 2.365 |
| Mn | 3.223 | 3.250 | 2.933 | 1.840 | 1.978 | 1.831 | 2.032 | 1.556 | 1.236 | 1.830 | 1.687 | 2.163 | 1.790 |
| Fe3+ | 0.436 | 0.514 | 0.380 | 0.335 | 0.297 | 0.263 | 0.360 | 0.280 | 0.307 | 0.248 | 0.184 | 0.390 | 0.294 |
| Ti | 0.699 | 0.683 | 1.073 | 1.893 | 2.024 | 2.284 | 1.737 | 2.193 | 2.291 | 2.395 | 2.327 | 2.356 | 2.529 |
| Nb | 0.395 | 0.403 | 0.632 | 1.552 | 1.288 | 1.743 | 1.199 | 2.253 | 2.663 | 1.793 | 2.338 | 2.390 | 2.320 |
| Ta | 7.961 | 8.002 | 7.582 | 6.631 | 6.833 | 6.272 | 6.940 | 5.865 | 5.423 | 6.275 | 5.444 | 5.560 | 5.633 |
| Sn | 2.399 | 2.320 | 2.167 | 1.505 | 1.469 | 1.365 | 1.665 | 1.328 | 1.238 | 1.288 | 1.694 | 1.292 | 1.210 |
| W | 0.073 | 0.056 | 0.063 | 0.047 | 0.050 | 0.038 | 0.079 | 0.046 | 0.033 | 0.000 | 0.012 | 0.004 | 0.011 |
| Pb | 0.000 | 0.000 | 0.002 | 0.003 | 0.003 | 0.003 | 0.000 | 0.008 | 0.011 | 0.003 | 0.005 | 0.008 | 0.005 |
| Th | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 |
| U | 0.005 | 0.005 | 0.011 | 0.004 | 0.007 | 0.005 | 0.005 | 0.010 | 0.019 | 0.000 | 0.000 | 0.007 | 0.000 |
| Sc | 0.011 | 0.011 | 0.018 | 0.021 | 0.021 | 0.021 | 0.011 | 0.020 | 0.016 | | | | |
| Sb | 0.018 | 0.000 | 0.068 | 0.008 | 0.008 | 0.003 | 0.003 | 0.005 | 0.008 | | | | |
| Bi | 0.002 | 0.006 | 0.005 | 0.003 | 0.002 | 0.003 | 0.000 | 0.000 | 0.002 | | | | |
| Total | 16.000 | 16.007 | 16.067 | 16.046 | 16.054 | 16.101 | 16.039 | 16.048 | 16.091 | 16.090 | 16.189 | 16.216 | 16.160 |
| Comments: | | | | | all data from single grain with patchy zonation | | | | | | | | |
| | | | | | FeTi wodginite occurs at margin | | | | | | inclusion 1 - SK, ZI, ZJ, ZK | | |
| | | | | | | | | | | | 220 µm | | |
| | wodg. | wodg. | wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | FeTi wodg. | Ti wodg. | FeTi wodg. |

**Marko's pegmatite**

| Raw data | YH | YI | YJ | YK | YL | YM | ZL | ZP | ZQ | ZS | ZT | YN | YO | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 94-44J | | | | | | | |
| FeO | 11.11 | 11.08 | 10.27 | 5.63 | 5.35 | 6.13 | 5.41 | 7.05 | 6.96 | 7.15 | 6.38 | 6.68 | 6.13 | 6.67 |
| MnO | 2.24 | 2.06 | 2.92 | 7.40 | 7.63 | 6.89 | 7.31 | 6.51 | 6.63 | 6.91 | 7.23 | 6.26 | 6.96 | 6.30 |
| TiO2 | 7.92 | 7.50 | 7.54 | 6.98 | 7.79 | 7.11 | 7.32 | 8.65 | 9.17 | 8.91 | 9.12 | 8.65 | 8.58 | 8.54 |
| Nb2O5 | 13.37 | 12.47 | 12.96 | 12.55 | 12.62 | 11.44 | 12.12 | 13.18 | 13.89 | 13.23 | 13.45 | 13.45 | 12.81 | 14.01 |
| Ta2O5 | 56.35 | 58.85 | 58.05 | 58.47 | 58.04 | 59.85 | 56.97 | 56.81 | 55.13 | 54.71 | 54.54 | 57.53 | 57.52 | 56.44 |
| SnO2 | 8.35 | 8.36 | 8.76 | 9.50 | 8.98 | 9.13 | 10.73 | 8.10 | 8.10 | 7.78 | 7.97 | 7.92 | 8.24 | 8.11 |
| WO3 | 0.05 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.09 | 0.06 | 0.06 | 0.12 | 0.01 | 0.04 | 0.06 |
| PbO | 0.02 | 0.02 | 0.03 | 0.10 | 0.07 | 0.05 | 0.02 | 0.03 | 0.07 | 0.03 | 0.05 | 0.07 | 0.07 | 0.03 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.04 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 99.42 | 100.36 | 100.53 | 100.63 | 100.48 | 100.67 | 99.90 | 100.49 | 100.02 | 98.79 | 98.88 | 100.57 | 100.37 | 100.16 |

| Recalculated oxides | YH | YI | YJ | YK | YL | YM | ZL | ZP | ZQ | ZS | ZT | YN | YO | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 94-44J | | | | | | | |
| Li2O | 0.00 | 0.02 | 0.01 | 0.02 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.02 |
| FeO | 10.31 | 10.25 | 9.50 | 4.84 | 4.74 | 5.33 | 5.02 | 6.30 | 6.31 | 6.13 | 5.66 | 6.18 | 5.59 | 6.16 |
| MnO | 2.24 | 2.06 | 2.92 | 7.40 | 7.63 | 6.89 | 7.31 | 6.51 | 6.63 | 6.91 | 7.23 | 6.26 | 6.96 | 6.30 |
| Fe2O3 | 0.89 | 0.90 | 0.84 | 0.87 | 0.67 | 0.88 | 0.43 | 0.83 | 0.71 | 1.12 | 0.80 | 0.55 | 0.60 | 0.56 |
| TiO2 | 7.92 | 7.50 | 7.54 | 6.98 | 7.79 | 7.11 | 7.32 | 8.65 | 9.17 | 8.91 | 9.12 | 8.65 | 8.58 | 8.54 |
| Nb2O5 | 13.37 | 12.47 | 12.96 | 12.55 | 12.62 | 11.44 | 12.12 | 13.18 | 13.89 | 13.23 | 13.45 | 13.45 | 12.81 | 14.01 |
| Ta2O5 | 56.35 | 58.85 | 58.05 | 58.47 | 58.04 | 59.85 | 56.97 | 56.81 | 55.13 | 54.71 | 54.54 | 57.53 | 57.52 | 56.44 |
| SnO2 | 8.35 | 8.36 | 8.76 | 9.50 | 8.98 | 9.13 | 10.73 | 8.10 | 8.10 | 7.78 | 7.97 | 7.92 | 8.24 | 8.11 |
| WO3 | 0.05 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.09 | 0.06 | 0.06 | 0.12 | 0.01 | 0.04 | 0.06 |
| PbO | 0.02 | 0.02 | 0.03 | 0.10 | 0.07 | 0.05 | 0.02 | 0.03 | 0.07 | 0.03 | 0.05 | 0.07 | 0.07 | 0.03 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.04 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 99.50 | 100.46 | 100.62 | 100.73 | 100.55 | 100.77 | 99.94 | 100.57 | 100.09 | 98.90 | 98.96 | 100.64 | 100.43 | 100.23 |

**Structural formulae based on 32 oxygens**

| | YH | YI | YJ | YK | YL | YM | ZL | ZP | ZQ | ZS | ZT | YN | YO | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.000 | 0.037 | 0.017 | 0.027 | 0.010 | 0.023 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.040 | 0.000 | 0.036 |
| Fe2+ | 3.303 | 3.292 | 3.036 | 1.557 | 1.516 | 1.721 | 1.622 | 1.988 | 1.984 | 1.954 | 1.798 | 1.952 | 1.774 | 1.946 |
| Mn | 0.727 | 0.669 | 0.944 | 2.406 | 2.467 | 2.251 | 2.390 | 2.080 | 2.109 | 2.228 | 2.327 | 2.001 | 2.236 | 2.015 |
| Fe3+ | 0.255 | 0.260 | 0.242 | 0.250 | 0.192 | 0.256 | 0.125 | 0.236 | 0.202 | 0.322 | 0.229 | 0.156 | 0.171 | 0.160 |
| Ti | 2.281 | 2.162 | 2.164 | 2.015 | 2.237 | 2.062 | 2.125 | 2.454 | 2.590 | 2.551 | 2.606 | 2.454 | 2.447 | 2.425 |
| Nb | 2.315 | 2.161 | 2.236 | 2.178 | 2.178 | 1.994 | 2.115 | 2.248 | 2.358 | 2.277 | 2.310 | 2.294 | 2.197 | 2.392 |
| Ta | 5.868 | 6.136 | 6.025 | 6.103 | 6.026 | 6.277 | 5.981 | 5.828 | 5.631 | 5.663 | 5.635 | 5.903 | 5.933 | 5.796 |
| Sn | 1.275 | 1.278 | 1.333 | 1.454 | 1.367 | 1.404 | 1.652 | 1.218 | 1.213 | 1.181 | 1.207 | 1.192 | 1.246 | 1.221 |
| W | 0.005 | 0.002 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.009 | 0.006 | 0.006 | 0.012 | 0.001 | 0.004 | 0.006 |
| Pb | 0.002 | 0.002 | 0.003 | 0.010 | 0.007 | 0.005 | 0.002 | 0.003 | 0.007 | 0.003 | 0.005 | 0.007 | 0.007 | 0.003 |
| Th | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| Sc | | | | | | | | | | | | | | |
| Sb | | | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | | | |
| Total | 16.031 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.014 | 16.071 | 16.101 | 16.185 | 16.130 | 16.000 | 16.017 | 16.000 |

Comments: all data from zoned inclusions in a cm sized cassiterite associated with antimonian microlite

inclusion 2 - YH, YI, YJ inclusion 3 - YK, YL, YM, ZL inclusion 4 - ZP, ZQ, ZS, ZT, YN, YO, YP, YW

200 µm 80 µm 200 µm

| | YH | YI | YJ | YK | YL | YM | ZL | ZP | ZQ | ZS | ZT | YN | YO | YP |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | FeTi wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. |
| | FeTi wodg. | | FeTi wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | | Ti wodg. | |

**Marko's pegmatite**

94-44J

| Raw data | YW | ZA | ZB | ZC | ZD | ZE | ZF | YA | YB | ZY | ZZ | YU | YV | YQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 6.83 | 6.79 | 5.51 | 4.57 | 7.85 | 7.23 | 7.22 | 4.65 | 5.54 | 5.11 | 5.21 | 6.76 | 7.66 | 8.87 |
| MnO | 6.02 | 6.53 | 7.79 | 9.49 | 6.16 | 6.61 | 6.56 | 8.56 | 7.84 | 8.32 | 8.32 | 6.39 | 5.65 | 4.51 |
| TiO2 | 8.06 | 8.73 | 9.25 | 9.84 | 8.20 | 9.48 | 8.19 | 7.88 | 7.40 | 6.90 | 7.46 | 7.91 | 8.25 | 7.89 |
| Nb2O5 | 13.23 | 14.57 | 15.20 | 15.66 | 14.61 | 14.76 | 14.55 | 12.47 | 13.54 | 13.00 | 12.49 | 14.28 | 15.35 | 13.75 |
| Ta2O5 | 58.07 | 56.15 | 54.44 | 53.68 | 54.98 | 53.37 | 54.11 | 55.76 | 56.60 | 55.62 | 55.39 | 56.08 | 55.22 | 56.75 |
| SnO2 | 8.43 | 7.49 | 7.56 | 6.85 | 8.65 | 7.41 | 8.47 | 10.02 | 9.22 | 9.97 | 10.06 | 8.45 | 8.49 | 8.52 |
| WO3 | 0.09 | 0.01 | 0.00 | 0.00 | 0.13 | 0.06 | 0.04 | 0.13 | 0.00 | 0.01 | 0.07 | 0.05 | 0.02 | 0.05 |
| PbO | 0.02 | 0.02 | 0.08 | 0.03 | 0.08 | 0.07 | 0.05 | 0.08 | 0.02 | 0.07 | 0.03 | 0.07 | 0.07 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.06 | 0.05 | 0.02 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 100.75 | 100.29 | 99.84 | 100.16 | 100.72 | 99.05 | 99.21 | 99.55 | 100.16 | 99.06 | 99.03 | 100.00 | 100.71 | 100.39 |

94-44J

| Recalculated oxides | YW | ZA | ZB | ZC | ZD | ZE | ZF | YA | YB | ZY | ZZ | YU | YV | YQ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 |
| FeO | 6.26 | 6.12 | 4.97 | 3.74 | 6.85 | 6.45 | 6.28 | 4.05 | 4.69 | 4.16 | 4.35 | 6.05 | 7.01 | 8.08 |
| MnO | 6.02 | 6.53 | 7.79 | 9.49 | 6.16 | 6.61 | 6.56 | 8.56 | 7.84 | 8.32 | 8.32 | 6.39 | 5.65 | 4.51 |
| Fe2O3 | 0.62 | 0.74 | 0.59 | 0.92 | 1.10 | 0.86 | 1.04 | 0.67 | 0.94 | 1.05 | 0.95 | 0.78 | 0.72 | 0.87 |
| TiO2 | 8.06 | 8.73 | 9.25 | 9.84 | 8.20 | 9.48 | 8.19 | 7.88 | 7.40 | 6.90 | 7.46 | 7.91 | 8.25 | 7.89 |
| Nb2O5 | 13.23 | 14.57 | 15.20 | 15.66 | 14.61 | 14.76 | 14.55 | 12.47 | 13.54 | 13.00 | 12.49 | 14.28 | 15.35 | 13.75 |
| Ta2O5 | 58.07 | 56.15 | 54.44 | 53.68 | 54.98 | 53.37 | 54.11 | 55.76 | 56.60 | 55.62 | 55.39 | 56.08 | 55.22 | 56.75 |
| SnO2 | 8.43 | 7.49 | 7.56 | 6.85 | 8.65 | 7.41 | 8.47 | 10.02 | 9.22 | 9.97 | 10.06 | 8.45 | 8.49 | 8.52 |
| WO3 | 0.09 | 0.01 | 0.00 | 0.00 | 0.13 | 0.06 | 0.04 | 0.13 | 0.00 | 0.01 | 0.07 | 0.05 | 0.02 | 0.05 |
| PbO | 0.02 | 0.02 | 0.08 | 0.03 | 0.08 | 0.07 | 0.05 | 0.08 | 0.02 | 0.07 | 0.03 | 0.07 | 0.07 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.02 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.06 | 0.05 | 0.02 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 100.85 | 100.36 | 99.90 | 100.25 | 100.82 | 99.13 | 99.31 | 99.61 | 100.25 | 99.16 | 99.12 | 100.08 | 100.78 | 100.47 |

**Structural formulae based on 32 oxygens**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.081 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.018 | 0.010 | 0.000 |
| Fe2+ | 1.986 | 1.923 | 1.556 | 1.156 | 2.146 | 2.027 | 1.993 | 1.300 | 1.497 | 1.348 | 1.406 | 1.921 | 2.193 | 2.564 |
| Mn | 1.931 | 2.076 | 2.467 | 2.967 | 1.953 | 2.103 | 2.108 | 2.783 | 2.533 | 2.730 | 2.722 | 2.053 | 1.789 | 1.448 |
| Fe3+ | 0.177 | 0.209 | 0.167 | 0.255 | 0.311 | 0.244 | 0.298 | 0.193 | 0.270 | 0.308 | 0.277 | 0.224 | 0.202 | 0.248 |
| Ti | 2.295 | 2.464 | 2.601 | 2.732 | 2.309 | 2.678 | 2.337 | 2.275 | 2.123 | 2.010 | 2.167 | 2.257 | 2.320 | 2.250 |
| Nb | 2.265 | 2.473 | 2.569 | 2.613 | 2.473 | 2.506 | 2.496 | 2.164 | 2.335 | 2.277 | 2.181 | 2.449 | 2.595 | 2.357 |
| Ta | 5.981 | 5.732 | 5.535 | 5.389 | 5.598 | 5.451 | 5.583 | 5.821 | 5.871 | 5.859 | 5.819 | 5.786 | 5.615 | 5.851 |
| Sn | 1.273 | 1.121 | 1.127 | 1.008 | 1.291 | 1.110 | 1.281 | 1.534 | 1.402 | 1.540 | 1.550 | 1.278 | 1.266 | 1.288 |
| W | 0.009 | 0.001 | 0.000 | 0.000 | 0.013 | 0.006 | 0.004 | 0.013 | 0.000 | 0.001 | 0.007 | 0.005 | 0.002 | 0.005 |
| Pb | 0.002 | 0.002 | 0.008 | 0.003 | 0.008 | 0.007 | 0.005 | 0.008 | 0.002 | 0.007 | 0.003 | 0.007 | 0.007 | 0.003 |
| Th | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.002 |
| U | 0.000 | 0.000 | 0.000 | 0.002 | 0.005 | 0.004 | 0.002 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | | | | | | | | | | | | | | |
| Sb | | | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | | | |
| Total | 16.000 | 16.001 | 16.031 | 16.126 | 16.108 | 16.137 | 16.106 | 16.091 | 16.032 | 16.085 | 16.132 | 16.000 | 16.000 | 16.015 |

Comments: all data from zoned inclusions in a cm sized cassiterite associated with antimonian microlite

inclusion 5 - ZA, ZB, ZC, ZD, ZE, ZF — 200 μm

inclusion 6 - YA, ZY, ZZ — 100 μm

inclusion 7 - YU, YV — 100 μm

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FeTi wodg. | Ti wodg. | Ti wodg. | Ti wodg. | FeTi wodg. | Ti wodg. | Ti wodg. | Ti wodg. | Ti wodg. | Ti wodg. | Ti wodg. | Ti wodg. | FeTi wodg. | FeTi wodg. |

## Wodginite Group

| | | | **Marko's pegmatite** | | | | | | **Marko's pegmatite** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94-44J | | | | | | 94-44K | | | |
| **Raw data** | YR | YS | YT | ZW | ZX | CG | CH | CJ | CT | CV | CX | CY |
| FeO | 8.86 | 7.64 | 6.41 | 5.73 | 5.83 | 10.67 | 9.70 | 10.27 | 7.33 | 10.43 | 5.87 | 11.04 |
| MnO | 4.40 | 5.73 | 6.65 | 7.43 | 7.69 | 3.01 | 3.12 | 3.30 | 5.90 | 2.90 | 7.60 | 2.73 |
| TiO2 | 7.86 | 7.53 | 7.93 | 8.49 | 7.52 | 7.10 | 7.32 | 7.60 | 7.42 | 7.61 | 8.40 | 8.20 |
| Nb2O5 | 13.57 | 13.14 | 12.95 | 12.64 | 12.92 | 13.90 | 12.86 | 12.59 | 13.53 | 13.64 | 14.70 | 15.90 |
| Ta2O5 | 57.17 | 57.73 | 57.50 | 57.27 | 56.21 | 55.75 | 56.72 | 56.71 | 56.97 | 55.58 | 54.31 | 53.53 |
| SnO2 | 8.38 | 8.81 | 8.54 | 8.27 | 8.85 | 9.30 | 8.58 | 8.47 | 8.37 | 8.42 | 8.12 | 8.23 |
| WO3 | 0.08 | 0.00 | 0.00 | 0.00 | 0.14 | 0.06 | 0.05 | 0.03 | 0.00 | 0.00 | 0.04 | 0.00 |
| PbO | 0.08 | 0.03 | 0.07 | 0.07 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.03 | 0.05 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | |
| Total | 100.40 | 100.61 | 100.05 | 99.90 | 99.28 | 99.82 | 98.38 | 98.99 | 99.54 | 98.61 | 99.09 | 99.71 |
| | | | | | | | | | | | | |
| Recalculated | | | 94-44J | | | | | | 94-44K | | | |
| oxides | YR | YS | YT | ZW | ZX | CG | CH | CJ | CT | CV | CX | CY |
| Li2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| FeO | 8.09 | 6.79 | 5.75 | 5.12 | 4.86 | 9.62 | 8.95 | 9.26 | 6.44 | 9.55 | 5.08 | 10.12 |
| MnO | 4.40 | 5.73 | 6.65 | 7.43 | 7.69 | 3.01 | 3.12 | 3.30 | 5.90 | 2.90 | 7.60 | 2.73 |
| Fe2O3 | 0.85 | 0.94 | 0.73 | 0.67 | 1.07 | 1.15 | 0.81 | 1.11 | 0.98 | 0.97 | 0.87 | 1.01 |
| TiO2 | 7.86 | 7.53 | 7.93 | 8.49 | 7.52 | 7.10 | 7.32 | 7.60 | 7.42 | 7.61 | 8.40 | 8.20 |
| Nb2O5 | 13.57 | 13.14 | 12.95 | 12.64 | 12.92 | 13.90 | 12.86 | 12.59 | 13.53 | 13.64 | 14.70 | 15.90 |
| Ta2O5 | 57.17 | 57.73 | 57.50 | 57.27 | 56.21 | 55.75 | 56.72 | 56.71 | 56.97 | 55.58 | 54.31 | 53.53 |
| SnO2 | 8.38 | 8.81 | 8.54 | 8.27 | 8.85 | 9.30 | 8.58 | 8.47 | 8.37 | 8.42 | 8.12 | 8.23 |
| WO3 | 0.08 | 0.00 | 0.00 | 0.00 | 0.14 | 0.06 | 0.05 | 0.03 | 0.00 | 0.00 | 0.04 | 0.00 |
| PbO | 0.08 | 0.03 | 0.07 | 0.07 | 0.03 | 0.03 | 0.03 | 0.02 | 0.02 | 0.03 | 0.05 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | | | | | | | | | | | | |
| Sb2O3 | | | | | | | | | | | | |
| Bi2O3 | | | | | | | | | | | | |
| Total | 100.48 | 100.70 | 100.12 | 99.96 | 99.38 | 99.93 | 98.48 | 99.09 | 99.64 | 98.70 | 99.17 | 99.80 |
| | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | |
| Li | 0.006 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.044 | 0.000 | 0.009 | 0.000 | 0.000 | 0.000 |
| Fe2+ | 2.571 | 2.164 | 1.839 | 1.633 | 1.565 | 3.081 | 2.923 | 2.996 | 2.070 | 3.084 | 1.613 | 3.183 |
| Mn | 1.415 | 1.848 | 2.152 | 2.399 | 2.507 | 0.975 | 1.030 | 1.080 | 1.918 | 0.948 | 2.442 | 0.868 |
| Fe3+ | 0.243 | 0.268 | 0.209 | 0.194 | 0.311 | 0.332 | 0.239 | 0.323 | 0.283 | 0.283 | 0.249 | 0.285 |
| Ti | 2.245 | 2.156 | 2.279 | 2.434 | 2.177 | 2.042 | 2.145 | 2.209 | 2.142 | 2.209 | 2.396 | 2.316 |
| Nb | 2.330 | 2.262 | 2.237 | 2.178 | 2.248 | 2.403 | 2.266 | 2.200 | 2.348 | 2.380 | 2.521 | 2.700 |
| Ta | 5.905 | 5.977 | 5.975 | 5.937 | 5.884 | 5.799 | 6.012 | 5.960 | 5.947 | 5.833 | 5.602 | 5.467 |
| Sn | 1.269 | 1.337 | 1.301 | 1.257 | 1.358 | 1.418 | 1.333 | 1.305 | 1.281 | 1.296 | 1.228 | 1.232 |
| W | 0.008 | 0.000 | 0.000 | 0.000 | 0.014 | 0.006 | 0.005 | 0.003 | 0.000 | 0.000 | 0.004 | 0.000 |
| Pb | 0.008 | 0.003 | 0.007 | 0.007 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.003 | 0.005 | 0.008 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | | | | | | | | | | | | |
| Sb | | | | | | | | | | | | |
| Bi | | | | | | | | | | | | |
| Total | 16.000 | 16.015 | 16.000 | 16.039 | 16.076 | 16.059 | 16.000 | 16.079 | 16.000 | 16.035 | 16.059 | 16.059 |
| | | | | | | | | | | | | |
| Comments: | | | | | | CG - CY separate inclusions in large zoned cassiterite grain | | | | | | |
| | inclusion 8 - YQ, YR | | | | | | | | | | | |
| | | FeTi wodg. | | Ti wodg. | | | | | | | | |
| | FeTi wodg. | | Ti wodg. | | Ti wodg. | | | all FeTi wodginite except CX | | | Ti wodg. | |

| | Marko's pegmatite | | | | Marko's pegmatite | | | | | Marko's pegmatite | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44K | | | | 94-44M | | | | | 94-44P | | | |
| **Raw data** | QH | QI | QJ | QM | LA | LD | LE | LJ | LK | CB | CF | CG | CH |
| FeO | 10.54 | 10.66 | 9.82 | 9.50 | 11.19 | 12.03 | 12.07 | 10.44 | 12.27 | 2.46 | 2.36 | 2.31 | 2.57 |
| MnO | 2.82 | 2.80 | 3.97 | 4.03 | 2.34 | 2.33 | 2.21 | 2.88 | 2.24 | 10.01 | 10.15 | 9.91 | 10.11 |
| TiO2 | 8.04 | 8.13 | 7.52 | 8.52 | 7.82 | 8.61 | 8.31 | 7.92 | 8.86 | 1.21 | 1.28 | 1.06 | 1.30 |
| Nb2O5 | 12.90 | 12.82 | 11.91 | 15.54 | 10.21 | 11.12 | 11.18 | 9.48 | 11.73 | 5.93 | 5.35 | 5.67 | 6.21 |
| Ta2O5 | 56.54 | 56.27 | 56.77 | 53.20 | 59.20 | 57.70 | 57.06 | 59.59 | 56.34 | 66.00 | 67.11 | 65.90 | 65.28 |
| SnO2 | 8.13 | 8.13 | 8.92 | 7.96 | 9.52 | 8.32 | 9.03 | 9.24 | 8.90 | 14.20 | 14.22 | 14.89 | 13.56 |
| WO3 | 0.04 | 0.05 | 0.08 | 0.05 | 0.02 | 0.00 | 0.01 | 0.02 | 0.11 | 0.18 | 0.21 | 0.25 | 0.23 |
| PbO | 0.08 | 0.07 | 0.05 | 0.11 | 0.03 | 0.08 | 0.02 | 0.08 | 0.06 | 0.02 | 0.00 | 0.02 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.05 | 0.12 | 0.11 | 0.08 | 0.09 | 0.03 | 0.08 | 0.09 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.06 | 0.06 | 0.06 | 0.05 | 0.03 | 0.05 | 0.06 | 0.06 | | | | |
| Sb2O3 | 0.50 | 0.09 | 0.06 | 0.06 | 0.06 | 0.08 | 0.05 | 0.05 | 0.03 | | | | |
| Bi2O3 | | | | | | | | | | | | | |
| Total | 99.14 | 99.05 | 99.15 | 98.99 | 100.41 | 100.22 | 99.97 | 99.74 | 100.59 | 100.01 | 100.69 | 100.01 | 99.28 |
| | | | | | | | | | | | | | |
| Recalculated | 94-44K | | | | 94-44M | | | | | 94-44P | | | |
| oxides | QH | QI | QJ | QM | LA | LD | LE | LJ | LK | CB | CF | CG | CH |
| Li2O | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.09 | 0.06 |
| FeO | 9.84 | 9.86 | 8.77 | 8.76 | 10.43 | 10.91 | 11.01 | 9.74 | 11.23 | 0.87 | 0.78 | 0.86 | 0.83 |
| MnO | 2.82 | 2.80 | 3.97 | 4.03 | 2.34 | 2.33 | 2.21 | 2.88 | 2.24 | 10.01 | 10.15 | 9.91 | 10.11 |
| Fe2O3 | 0.75 | 0.88 | 1.15 | 0.81 | 0.83 | 1.22 | 1.16 | 0.77 | 1.13 | 1.76 | 1.75 | 1.60 | 1.93 |
| TiO2 | 8.04 | 8.13 | 7.52 | 8.52 | 7.82 | 8.61 | 8.31 | 7.92 | 8.86 | 1.21 | 1.28 | 1.06 | 1.30 |
| Nb2O5 | 12.90 | 12.82 | 11.91 | 15.54 | 10.21 | 11.12 | 11.18 | 9.48 | 11.73 | 5.93 | 5.35 | 5.67 | 6.21 |
| Ta2O5 | 56.54 | 56.27 | 56.77 | 53.20 | 59.20 | 57.70 | 57.06 | 59.59 | 56.34 | 66.00 | 67.11 | 65.90 | 65.28 |
| SnO2 | 8.13 | 8.13 | 8.92 | 7.96 | 9.52 | 8.32 | 9.03 | 9.24 | 8.90 | 14.20 | 14.22 | 14.89 | 13.56 |
| WO3 | 0.04 | 0.05 | 0.08 | 0.05 | 0.02 | 0.00 | 0.01 | 0.02 | 0.11 | 0.18 | 0.21 | 0.25 | 0.23 |
| PbO | 0.08 | 0.07 | 0.05 | 0.11 | 0.03 | 0.08 | 0.02 | 0.08 | 0.06 | 0.02 | 0.00 | 0.02 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.05 | 0.12 | 0.11 | 0.08 | 0.09 | 0.03 | 0.08 | 0.09 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.06 | 0.06 | 0.06 | 0.05 | 0.03 | 0.05 | 0.06 | 0.06 | | | | |
| Sb2O3 | 0.50 | 0.09 | 0.06 | 0.06 | 0.06 | 0.08 | 0.05 | 0.05 | 0.03 | | | | |
| Bi2O3 | | | | | | | | | | | | | |
| Total | 99.72 | 99.27 | 99.37 | 99.18 | 100.59 | 100.43 | 100.17 | 99.92 | 100.78 | 100.25 | 100.93 | 100.25 | 99.52 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.131 | 0.129 | 0.159 | 0.095 |
| Fe2+ | 3.162 | 3.170 | 2.842 | 2.769 | 3.368 | 3.480 | 3.527 | 3.177 | 3.550 | 0.306 | 0.273 | 0.304 | 0.292 |
| Mn | 0.915 | 0.911 | 1.301 | 1.288 | 0.765 | 0.753 | 0.715 | 0.949 | 0.715 | 3.560 | 3.597 | 3.535 | 3.611 |
| Fe3+ | 0.216 | 0.254 | 0.335 | 0.230 | 0.242 | 0.352 | 0.333 | 0.225 | 0.321 | 0.558 | 0.552 | 0.509 | 0.614 |
| Ti | 2.317 | 2.348 | 2.187 | 2.418 | 2.268 | 2.466 | 2.390 | 2.320 | 2.514 | 0.382 | 0.403 | 0.336 | 0.412 |
| Nb | 2.235 | 2.226 | 2.083 | 2.652 | 1.780 | 1.915 | 1.933 | 1.670 | 2.001 | 1.126 | 1.012 | 1.080 | 1.184 |
| Ta | 5.892 | 5.877 | 5.972 | 5.461 | 6.211 | 5.978 | 5.934 | 6.312 | 5.782 | 7.537 | 7.637 | 7.548 | 7.485 |
| Sn | 1.242 | 1.245 | 1.376 | 1.198 | 1.464 | 1.264 | 1.377 | 1.435 | 1.340 | 2.378 | 2.373 | 2.500 | 2.280 |
| W | 0.004 | 0.005 | 0.008 | 0.005 | 0.002 | 0.000 | 0.001 | 0.002 | 0.011 | 0.020 | 0.023 | 0.027 | 0.025 |
| Pb | 0.008 | 0.007 | 0.005 | 0.011 | 0.003 | 0.008 | 0.002 | 0.008 | 0.006 | 0.002 | 0.000 | 0.002 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| U | 0.004 | 0.010 | 0.009 | 0.007 | 0.008 | 0.003 | 0.007 | 0.008 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.010 | 0.020 | 0.020 | 0.020 | 0.017 | 0.010 | 0.017 | 0.020 | 0.020 | | | | |
| Sb | 0.079 | 0.014 | 0.010 | 0.009 | 0.010 | 0.013 | 0.008 | 0.008 | 0.005 | | | | |
| Bi | | | | | | | | | | | | | |
| Total | 16.085 | 16.088 | 16.147 | 16.068 | 16.137 | 16.241 | 16.244 | 16.134 | 16.270 | 16.000 | 16.000 | 16.000 | 16.000 |
| | | | | | | | | | | | | | |
| Comments: | QH - QJ same grain inclusion in large zoned cassiterite | | | | separate inclusions in large cassiterite grain | | | | | four individual grains | | | marginally replaced with microlite |
| | all ferrotitanowodginite | | | | all ferrotitanowodginite | | | | | all wodginite | | | |

| | **Marko's pegmatite** | | | | | | | **Marko's pegmatite** | | | | | **Marko's** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44R | | | | | | | 94-44S | | | | | 94-44T |
| Raw data | DI | YA | YB | YC | YD | YG | YH | DD | DE | DF | DG | DH | EA |
| FeO | 2.51 | 2.50 | 2.60 | 2.65 | 2.67 | 2.48 | 2.72 | 2.37 | 2.35 | 2.41 | 2.38 | 2.35 | 2.17 |
| MnO | 10.05 | 9.91 | 10.20 | 10.15 | 9.86 | 10.12 | 9.93 | 9.98 | 9.67 | 9.68 | 9.99 | 9.91 | 10.21 |
| TiO2 | 1.23 | 1.13 | 1.29 | 1.11 | 1.14 | 1.11 | 0.95 | 1.11 | 1.14 | 1.29 | 1.16 | 1.14 | 1.20 |
| Nb2O5 | 5.92 | 5.81 | 6.15 | 6.46 | 6.31 | 6.46 | 6.76 | 5.95 | 5.82 | 5.90 | 6.11 | 5.91 | 4.90 |
| Ta2O5 | 66.14 | 65.06 | 65.17 | 64.53 | 64.88 | 64.08 | 63.21 | 65.03 | 65.50 | 64.92 | 64.72 | 64.76 | 65.95 |
| SnO2 | 14.17 | 15.05 | 13.81 | 14.12 | 14.60 | 15.18 | 14.94 | 14.71 | 15.03 | 14.48 | 14.30 | 14.80 | 14.82 |
| WO3 | 0.13 | 0.25 | 0.13 | 0.30 | 0.20 | 0.26 | 0.39 | 0.23 | 0.22 | 0.28 | 0.40 | 0.37 | 0.22 |
| PbO | 0.03 | 0.05 | 0.02 | 0.10 | 0.07 | 0.08 | 0.03 | 0.07 | 0.05 | 0.08 | 0.10 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.06 | 0.00 | 0.09 | 0.11 | 0.05 | 0.12 | 0.01 | 0.07 | 0.02 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | | 0.02 | 0.05 | 0.02 | 0.03 | 0.03 | 0.05 | | | | | | |
| Sb2O3 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | | | | | | |
| Bi2O3 | | 0.00 | 0.03 | 0.00 | 0.03 | 0.03 | 0.00 | | | | | | |
| Total | 100.18 | 99.82 | 99.37 | 99.51 | 99.84 | 99.82 | 99.05 | 99.47 | 99.85 | 99.06 | 99.16 | 99.25 | 99.47 |
| | | | | | | | | | | | | | |
| Recalculated | 94-44R | | | | | | | 94-44S | | | | | 94-44T |
| oxides | DI | YA | YB | YC | YD | YG | YH | DD | DE | DF | DG | DH | EA |
| Li2O | 0.07 | 0.05 | 0.02 | 0.03 | 0.05 | 0.03 | 0.03 | 0.07 | 0.11 | 0.09 | 0.08 | 0.08 | 0.05 |
| FeO | 0.89 | 1.05 | 0.91 | 0.91 | 1.13 | 0.98 | 1.13 | 0.86 | 1.02 | 1.00 | 0.79 | 0.89 | 0.70 |
| MnO | 10.05 | 9.91 | 10.20 | 10.15 | 9.86 | 10.12 | 9.93 | 9.98 | 9.67 | 9.68 | 9.99 | 9.91 | 10.21 |
| Fe2O3 | 1.79 | 1.61 | 1.88 | 1.93 | 1.70 | 1.66 | 1.76 | 1.67 | 1.47 | 1.56 | 1.76 | 1.62 | 1.63 |
| TiO2 | 1.23 | 1.13 | 1.29 | 1.11 | 1.14 | 1.11 | 0.95 | 1.11 | 1.14 | 1.29 | 1.16 | 1.14 | 1.20 |
| Nb2O5 | 5.92 | 5.81 | 6.15 | 6.46 | 6.31 | 6.46 | 6.76 | 5.95 | 5.82 | 5.90 | 6.11 | 5.91 | 4.90 |
| Ta2O5 | 66.14 | 65.06 | 65.17 | 64.53 | 64.88 | 64.08 | 63.21 | 65.03 | 65.50 | 64.92 | 64.72 | 64.76 | 65.95 |
| SnO2 | 14.17 | 15.05 | 13.81 | 14.12 | 14.60 | 15.18 | 14.94 | 14.71 | 15.03 | 14.48 | 14.30 | 14.80 | 14.82 |
| WO3 | 0.13 | 0.25 | 0.13 | 0.30 | 0.20 | 0.26 | 0.39 | 0.23 | 0.22 | 0.28 | 0.40 | 0.37 | 0.22 |
| PbO | 0.03 | 0.05 | 0.02 | 0.10 | 0.07 | 0.08 | 0.03 | 0.07 | 0.05 | 0.08 | 0.10 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.06 | 0.00 | 0.09 | 0.11 | 0.05 | 0.12 | 0.01 | 0.07 | 0.02 | 0.00 | 0.01 | 0.00 |
| Sc2O3 | | 0.02 | 0.05 | 0.02 | 0.03 | 0.03 | 0.05 | | | | | | |
| Sb2O3 | | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | | | | | | |
| Bi2O3 | | 0.00 | 0.03 | 0.00 | 0.03 | 0.03 | 0.00 | | | | | | |
| Total | 100.42 | 100.04 | 99.66 | 99.76 | 100.11 | 100.07 | 99.30 | 99.70 | 100.09 | 99.30 | 99.40 | 99.48 | 99.67 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.114 | 0.088 | 0.038 | 0.050 | 0.087 | 0.048 | 0.046 | 0.115 | 0.182 | 0.161 | 0.128 | 0.134 | 0.077 |
| Fe2+ | 0.314 | 0.370 | 0.320 | 0.320 | 0.398 | 0.346 | 0.399 | 0.305 | 0.361 | 0.356 | 0.281 | 0.315 | 0.249 |
| Mn | 2.569 | 3.537 | 3.640 | 3.619 | 3.508 | 3.597 | 3.552 | 3.572 | 3.452 | 3.474 | 3.579 | 3.552 | 3.674 |
| Fe3+ | 0.566 | 0.511 | 0.596 | 0.613 | 0.540 | 0.524 | 0.561 | 0.533 | 0.467 | 0.498 | 0.561 | 0.517 | 0.522 |
| Ti | 0.388 | 0.358 | 0.409 | 0.351 | 0.360 | 0.350 | 0.302 | 0.353 | 0.361 | 0.411 | 0.369 | 0.363 | 0.383 |
| Nb | 1.122 | 1.107 | 1.171 | 1.229 | 1.198 | 1.226 | 1.290 | 1.137 | 1.109 | 1.130 | 1.169 | 1.130 | 0.941 |
| Ta | 7.541 | 7.455 | 7.466 | 7.386 | 7.410 | 7.313 | 7.259 | 7.473 | 7.506 | 7.481 | 7.445 | 7.451 | 7.619 |
| Sn | 2.369 | 2.529 | 2.320 | 2.370 | 2.445 | 2.540 | 2.516 | 2.478 | 2.526 | 2.447 | 2.412 | 2.497 | 2.510 |
| W | 0.014 | 0.027 | 0.014 | 0.033 | 0.022 | 0.028 | 0.043 | 0.025 | 0.024 | 0.031 | 0.044 | 0.041 | 0.024 |
| Pb | 0.003 | 0.006 | 0.002 | 0.011 | 0.008 | 0.009 | 0.003 | 0.008 | 0.006 | 0.009 | 0.011 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.006 | 0.000 | 0.008 | 0.010 | 0.005 | 0.011 | 0.001 | 0.007 | 0.002 | 0.000 | 0.001 | 0.000 |
| Sc | | 0.007 | 0.018 | 0.007 | 0.011 | 0.011 | 0.018 | | | | | | |
| Sb | | 0.000 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | | | | | | |
| Bi | | 0.000 | 0.003 | 0.000 | 0.003 | 0.003 | 0.000 | | | | | | |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| | | | | | | | | | | | | | |
| Comments: | many grains are marginally replaced with microlite | | | | | | | DD - DH from same large grain | | | | | |
| | | | YA - YC | | | YG & YH | | associated with cassiterite | | | | | |
| | | | same grain | | | same grain | | | | | | | |
| | | | all wodginite | | | | | | all wodginite | | | | wodginite |

| | **Marko's peg.** | | **Marko's** | **Marko's peg.** | | **Marko's pegmatite** | | | | **Marko's pegmatite** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44T | | 94-44U | 94-44V | | 94-44ii | | | | 94-44iii(V1) | | |
| **Raw data** | EB | EE | XG | ED | EE | EA | EB | EC | ED | AA | AB | AC |
| FeO | 2.48 | 2.10 | 4.33 | 2.21 | 2.78 | 2.41 | 2.37 | 2.39 | 2.58 | 2.39 | 2.65 | 2.30 |
| MnO | 9.94 | 10.03 | 7.81 | 10.46 | 10.41 | 9.73 | 9.59 | 9.66 | 9.81 | 9.67 | 9.83 | 9.92 |
| TiO2 | 1.18 | 1.06 | 4.56 | 1.11 | 1.09 | 1.03 | 1.08 | 1.16 | 0.82 | 1.06 | 1.00 | 1.04 |
| Nb2O5 | 6.07 | 5.31 | 10.52 | 6.05 | 6.59 | 6.09 | 5.86 | 6.10 | 6.44 | 5.76 | 6.45 | 5.94 |
| Ta2O5 | 66.45 | 66.26 | 57.49 | 65.42 | 65.28 | 64.90 | 65.10 | 65.41 | 64.34 | 65.28 | 64.68 | 65.70 |
| SnO2 | 14.45 | 15.12 | 12.02 | 14.90 | 14.63 | 14.79 | 14.55 | 14.11 | 14.90 | 14.88 | 14.08 | 14.68 |
| WO3 | 0.29 | 0.26 | 0.39 | 0.14 | 0.12 | 0.29 | 0.37 | 0.36 | 0.67 | 0.38 | 0.41 | 0.29 |
| PbO | 0.00 | 0.03 | 0.03 | 0.02 | 0.03 | 0.05 | 0.07 | 0.05 | 0.05 | 0.12 | 0.03 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.06 | 0.03 | 0.01 | 0.03 | 0.07 |
| Sc2O3 | | | 0.37 | | | 0.02 | 0.06 | 0.02 | 0.05 | 0.02 | 0.05 | 0.02 |
| Sb2O3 | | | 0.00 | | | | | | | | | |
| Bi2O3 | | | 0.05 | | | | | | | | | |
| Total | 100.86 | 100.17 | 97.63 | 100.32 | 100.94 | 99.35 | 99.02 | 99.30 | 99.64 | 99.55 | 99.16 | 99.97 |
| **Recalculated** | 94-44T | | 94-44U | 94-44V | | 94-44ii | | | | 94-44iii(V1) | | |
| **oxides** | EB | EE | XG | ED | EE | EA | EB | EC | ED | AA | AB | AC |
| Li2O | 0.10 | 0.10 | 0.02 | 0.04 | 0.00 | 0.10 | 0.11 | 0.13 | 0.09 | 0.10 | 0.08 | 0.10 |
| FeO | 0.93 | 0.71 | 3.74 | 0.63 | 0.97 | 0.97 | 0.99 | 0.91 | 0.99 | 0.98 | 0.99 | 0.83 |
| MnO | 9.94 | 10.03 | 7.81 | 10.46 | 10.41 | 9.73 | 9.59 | 9.66 | 9.81 | 9.67 | 9.83 | 9.92 |
| Fe2O3 | 1.71 | 1.53 | 0.63 | 1.75 | 2.00 | 1.58 | 1.52 | 1.63 | 1.75 | 1.55 | 1.84 | 1.63 |
| TiO2 | 1.18 | 1.06 | 4.56 | 1.11 | 1.09 | 1.03 | 1.08 | 1.16 | 0.82 | 1.06 | 1.00 | 1.04 |
| Nb2O5 | 6.07 | 5.31 | 10.52 | 6.05 | 6.59 | 6.09 | 5.86 | 6.10 | 6.44 | 5.76 | 6.45 | 5.94 |
| Ta2O5 | 66.45 | 66.26 | 57.49 | 65.42 | 65.28 | 64.90 | 65.10 | 65.41 | 64.34 | 65.28 | 64.68 | 65.70 |
| SnO2 | 14.45 | 15.12 | 12.02 | 14.90 | 14.63 | 14.79 | 14.55 | 14.11 | 14.90 | 14.88 | 14.08 | 14.68 |
| WO3 | 0.29 | 0.26 | 0.39 | 0.14 | 0.12 | 0.29 | 0.37 | 0.36 | 0.67 | 0.38 | 0.41 | 0.29 |
| PbO | 0.00 | 0.03 | 0.03 | 0.02 | 0.03 | 0.05 | 0.07 | 0.05 | 0.05 | 0.12 | 0.03 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.06 | 0.03 | 0.01 | 0.03 | 0.07 |
| Sc2O3 | | | 0.37 | | | 0.02 | 0.06 | 0.02 | 0.05 | 0.02 | 0.05 | 0.02 |
| Sb2O3 | | | 0.00 | | | | | | | | | |
| Bi2O3 | | | 0.05 | | | | | | | | | |
| Total | 101.12 | 100.41 | 97.62 | 100.53 | 101.14 | 99.61 | 99.33 | 99.60 | 99.94 | 99.82 | 99.46 | 100.24 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | |
| Li | 0.172 | 0.163 | 0.032 | 0.065 | 0.000 | 0.163 | 0.192 | 0.214 | 0.146 | 0.173 | 0.131 | 0.170 |
| Fe2+ | 0.324 | 0.253 | 1.276 | 0.223 | 0.339 | 0.346 | 0.352 | 0.323 | 0.351 | 0.349 | 0.350 | 0.292 |
| Mn | 3.504 | 3.581 | 2.688 | 3.710 | 3.658 | 3.485 | 3.448 | 3.457 | 3.497 | 3.464 | 3.516 | 3.535 |
| Fe3+ | 0.539 | 0.487 | 0.194 | 0.551 | 0.626 | 0.506 | 0.489 | 0.521 | 0.557 | 0.496 | 0.586 | 0.517 |
| Ti | 0.369 | 0.336 | 1.394 | 0.350 | 0.340 | 0.328 | 0.345 | 0.369 | 0.260 | 0.337 | 0.318 | 0.329 |
| Nb | 1.142 | 1.012 | 1.932 | 1.145 | 1.236 | 1.164 | 1.124 | 1.165 | 1.225 | 1.101 | 1.231 | 1.130 |
| Ta | 7.521 | 7.595 | 6.355 | 7.450 | 7.365 | 7.463 | 7.514 | 7.515 | 7.364 | 7.507 | 7.428 | 7.516 |
| Sn | 2.398 | 2.541 | 1.948 | 2.488 | 2.420 | 2.494 | 2.462 | 2.377 | 2.500 | 2.509 | 2.371 | 2.462 |
| W | 0.031 | 0.028 | 0.041 | 0.015 | 0.013 | 0.032 | 0.041 | 0.039 | 0.073 | 0.042 | 0.045 | 0.032 |
| Pb | 0.000 | 0.003 | 0.004 | 0.002 | 0.003 | 0.006 | 0.008 | 0.006 | 0.006 | 0.014 | 0.003 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.002 | 0.006 | 0.003 | 0.001 | 0.003 | 0.007 |
| Sc | | | 0.130 | | | 0.007 | 0.022 | 0.007 | 0.018 | 0.007 | 0.018 | 0.007 |
| Sb | | | 0.000 | | | | | | | | | |
| Bi | | | 0.005 | | | | | | | | | |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | EB is<br>marginally<br>altered<br>to microlite | | inclusion<br>in<br>cassiterite | complex wodginite-<br>microlite grain<br>50% of each | | EA - EC<br>same grain | | | ED partially<br>altered<br>to microlite | AA & AB<br>same grain<br>large, unzoned<br>and unaltered | | |
| | wodginite | | | wodginite | | all wodginite | | | | all wodginite | | |

|  | Marko's peg. |  |  |  |  |  |  |  |  |  | Pegmatite 5 |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  |  |  | Marko's pegmatite |  |  |  |  |  |  |  |  |
|  | 94-44iii(V1) |  |  |  | 94-44iii(V2) |  |  |  |  |  | 94-80D |  |  |
| **Raw data** | AD | AE | IA | IC | ID | IE | IF | IG | GC | GD | GE | GF | GH |
| FeO | 2.44 | 2.40 | 2.43 | 2.65 | 2.66 | 2.29 | 2.53 | 2.26 | 7.80 | 7.96 | 7.88 | 8.44 | 8.27 |
| MnO | 9.76 | 9.65 | 9.66 | 9.75 | 9.77 | 9.65 | 9.68 | 9.87 | 5.37 | 5.17 | 5.10 | 5.46 | 4.87 |
| TiO2 | 0.98 | 1.01 | 1.03 | 0.95 | 1.00 | 1.04 | 1.24 | 0.98 | 1.00 | 1.06 | 1.67 | 1.22 | 1.27 |
| Nb2O5 | 6.28 | 6.10 | 6.33 | 6.63 | 6.40 | 5.81 | 6.14 | 5.78 | 7.90 | 7.05 | 6.82 | 6.64 | 5.83 |
| Ta2O5 | 64.05 | 64.61 | 65.18 | 64.61 | 64.60 | 65.49 | 65.72 | 65.31 | 59.91 | 63.59 | 62.97 | 63.03 | 63.33 |
| SnO2 | 15.04 | 14.74 | 14.75 | 14.40 | 14.47 | 14.91 | 13.48 | 14.74 | 13.54 | 11.97 | 11.90 | 12.41 | 11.11 |
| WO3 | 0.43 | 0.40 | 0.34 | 0.38 | 0.40 | 0.25 | 0.23 | 0.32 | 4.65 | 2.57 | 2.98 | 2.00 | 4.54 |
| PbO | 0.03 | 0.08 | 0.05 | 0.10 | 0.10 | 0.08 | 0.03 | 0.08 | 0.03 | 0.00 | 0.00 | 0.05 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.08 | 0.04 | 0.06 | 0.14 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.05 | 0.02 | 0.05 | 0.03 | 0.02 | 0.02 | 0.02 | 0.03 | 0.12 | 0.26 | 0.00 | 0.00 | 0.24 |
| Sb2O3 |  |  |  |  |  |  |  |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 |  |  |  |  |  |  |  |  | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total | 99.07 | 99.07 | 99.81 | 99.53 | 99.54 | 99.52 | 99.13 | 99.34 | 100.33 | 99.63 | 99.32 | 99.25 | 99.46 |
| Recalculated | 94-44iii(V1) |  |  |  | 94-44iii(V2) |  |  |  |  |  | 94-80D |  |  |
| oxides | AD | AE | IA | IC | ID | IE | IF | IG | GC | GD | GE | GF | GH |
| Li2O | 0.08 | 0.10 | 0.12 | 0.09 | 0.07 | 0.12 | 0.11 | 0.10 | 0.16 | 0.11 | 0.14 | 0.00 | 0.16 |
| FeO | 1.02 | 0.97 | 1.02 | 1.03 | 1.06 | 0.94 | 0.94 | 0.80 | 5.43 | 5.68 | 5.60 | 5.89 | 5.69 |
| MnO | 9.76 | 9.65 | 9.66 | 9.75 | 9.77 | 9.65 | 9.68 | 9.87 | 5.37 | 5.17 | 5.10 | 5.46 | 4.87 |
| Fe2O3 | 1.57 | 1.58 | 1.55 | 1.78 | 1.77 | 1.49 | 1.76 | 1.61 | 2.58 | 2.47 | 2.48 | 2.81 | 2.78 |
| TiO2 | 0.98 | 1.01 | 1.03 | 0.95 | 1.00 | 1.04 | 1.24 | 0.98 | 1.00 | 1.06 | 1.67 | 1.22 | 1.27 |
| Nb2O5 | 6.28 | 6.10 | 6.33 | 6.63 | 6.40 | 5.81 | 6.14 | 5.78 | 7.90 | 7.05 | 6.82 | 6.64 | 5.83 |
| Ta2O5 | 64.05 | 64.61 | 65.18 | 64.61 | 64.60 | 65.49 | 65.72 | 65.31 | 59.91 | 63.59 | 62.97 | 63.03 | 63.33 |
| SnO2 | 15.04 | 14.74 | 14.75 | 14.40 | 14.47 | 14.91 | 13.48 | 14.74 | 13.54 | 11.97 | 11.90 | 12.41 | 11.11 |
| WO3 | 0.43 | 0.40 | 0.34 | 0.38 | 0.40 | 0.25 | 0.23 | 0.32 | 4.65 | 2.57 | 2.98 | 2.00 | 4.54 |
| PbO | 0.03 | 0.08 | 0.05 | 0.10 | 0.10 | 0.08 | 0.03 | 0.08 | 0.03 | 0.00 | 0.00 | 0.05 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.08 | 0.04 | 0.06 | 0.14 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.05 | 0.02 | 0.05 | 0.03 | 0.02 | 0.02 | 0.02 | 0.03 | 0.12 | 0.26 | 0.00 | 0.00 | 0.24 |
| Sb2O3 |  |  |  |  |  |  |  |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 |  |  |  |  |  |  |  |  | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total | 99.35 | 99.34 | 100.12 | 99.81 | 99.80 | 99.80 | 99.43 | 99.62 | 100.68 | 99.93 | 99.66 | 99.51 | 99.83 |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.136 | 0.180 | 0.196 | 0.147 | 0.127 | 0.200 | 0.196 | 0.163 | 0.259 | 0.185 | 0.243 | 0.000 | 0.273 |
| Fe2+ | 0.361 | 0.345 | 0.360 | 0.365 | 0.374 | 0.334 | 0.333 | 0.285 | 1.874 | 1.993 | 1.959 | 2.067 | 2.004 |
| Mn | 3.500 | 3.466 | 3.438 | 3.476 | 3.488 | 3.457 | 3.467 | 3.543 | 1.865 | 1.822 | 1.798 | 1.937 | 1.723 |
| Fe3+ | 0.502 | 0.506 | 0.494 | 0.567 | 0.564 | 0.476 | 0.561 | 0.516 | 0.801 | 0.780 | 0.781 | 0.889 | 0.882 |
| Ti | 0.312 | 0.322 | 0.325 | 0.301 | 0.317 | 0.331 | 0.394 | 0.312 | 0.309 | 0.333 | 0.521 | 0.384 | 0.400 |
| Nb | 1.202 | 1.169 | 1.202 | 1.262 | 1.219 | 1.111 | 1.174 | 1.107 | 1.464 | 1.326 | 1.282 | 1.256 | 1.100 |
| Ta | 7.374 | 7.451 | 7.448 | 7.395 | 7.404 | 7.533 | 7.558 | 7.527 | 6.677 | 7.202 | 7.122 | 7.180 | 7.190 |
| Sn | 2.539 | 2.492 | 2.471 | 2.417 | 2.432 | 2.515 | 2.273 | 2.491 | 2.212 | 1.987 | 1.973 | 2.073 | 1.849 |
| W | 0.047 | 0.044 | 0.037 | 0.041 | 0.044 | 0.027 | 0.025 | 0.035 | 0.494 | 0.277 | 0.321 | 0.217 | 0.491 |
| Pb | 0.003 | 0.009 | 0.006 | 0.011 | 0.011 | 0.009 | 0.003 | 0.009 | 0.003 | 0.000 | 0.000 | 0.006 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.006 | 0.008 | 0.004 | 0.006 | 0.013 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.018 | 0.007 | 0.018 | 0.011 | 0.007 | 0.007 | 0.007 | 0.011 | 0.044 | 0.094 | 0.001 | 0.000 | 0.088 |
| Sb |  |  |  |  |  |  |  |  | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi |  |  |  |  |  |  |  |  | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.010 | 16.000 |
| Comments: | AC- AE |  | associated | IC - ID |  | IE & IF |  |  | GC - GH & GZ1 - GZ14 same grain |  |  |  |  |
|  | same grain |  | with | same grain |  | same grain |  |  | contains inclusions of uranmicrolite |  |  |  |  |
|  |  |  | Mn tantalite | large, unzoned and unaltered |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | all wodginite |  |  |  |  |  | all ferrowodginite |  |  |

**Pegmatite 5**

94-80D

| Raw data | GZ1 | GZ2 | GZ3 | GZ4 | GZ5 | GZ7 | GZ8 | GZ9 | GZ10 | GZ11 | GZ12 | GZ13 | GZ14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 7.67 | 7.96 | 8.29 | 8.00 | 8.36 | 8.08 | 7.74 | 8.35 | 8.41 | 8.46 | 8.59 | 8.38 | 7.80 |
| MnO | 5.31 | 5.31 | 5.02 | 5.07 | 4.96 | 5.12 | 5.06 | 4.86 | 4.89 | 4.89 | 4.85 | 5.05 | 5.17 |
| TiO2 | 0.95 | 1.61 | 1.02 | 1.57 | 1.31 | 1.47 | 1.37 | 1.30 | 1.35 | 1.38 | 1.43 | 1.33 | 1.63 |
| Nb2O5 | 7.16 | 6.80 | 6.80 | 5.56 | 6.31 | 6.74 | 5.07 | 5.84 | 5.84 | 7.12 | 6.87 | 6.84 | 6.78 |
| Ta2O5 | 60.25 | 62.45 | 59.87 | 65.05 | 62.11 | 62.23 | 65.07 | 62.62 | 62.28 | 60.63 | 62.04 | 61.62 | 63.38 |
| SnO2 | 12.84 | 11.13 | 12.60 | 10.81 | 11.10 | 11.74 | 11.09 | 10.99 | 10.85 | 10.94 | 10.78 | 10.89 | 11.57 |
| WO3 | 4.96 | 3.40 | 4.67 | 2.27 | 4.23 | 3.04 | 2.57 | 4.31 | 4.74 | 4.44 | 4.71 | 4.83 | 2.77 |
| PbO | 0.02 | 0.02 | 0.00 | 0.08 | 0.01 | 0.01 | 0.00 | 0.01 | 0.08 | 0.00 | 0.02 | 0.00 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 |
| Sc2O3 | 0.15 | 0.06 | 0.18 | 0.07 | 0.09 | 0.23 | 0.07 | 0.10 | 0.05 | 0.18 | 0.09 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 |
| Total | 99.30 | 98.74 | 98.45 | 98.49 | 98.48 | 98.66 | 98.06 | 98.38 | 98.50 | 98.07 | 99.38 | 98.93 | 99.35 |
| | | | | | | | | | | | | | |
| Recalculated | | | | | | | 94-80D | | | | | | |
| oxides | GZ1 | GZ2 | GZ3 | GZ4 | GZ5 | GZ7 | GZ8 | GZ9 | GZ10 | GZ11 | GZ12 | GZ13 | GZ14 |
| Li2O | 0.18 | 0.12 | 0.11 | 0.10 | 0.13 | 0.08 | 0.13 | 0.15 | 0.15 | 0.13 | 0.16 | 0.17 | 0.14 |
| FeO | 5.22 | 5.44 | 5.76 | 5.61 | 5.66 | 5.79 | 5.40 | 5.67 | 5.61 | 5.79 | 5.78 | 5.49 | 5.48 |
| MnO | 5.31 | 5.31 | 5.02 | 5.07 | 4.96 | 5.12 | 5.06 | 4.86 | 4.89 | 4.89 | 4.85 | 5.05 | 5.17 |
| Fe2O3 | 2.65 | 2.75 | 2.75 | 2.61 | 2.93 | 2.49 | 2.54 | 2.91 | 3.05 | 2.89 | 3.04 | 3.13 | 2.52 |
| TiO2 | 0.95 | 1.61 | 1.02 | 1.57 | 1.31 | 1.47 | 1.37 | 1.30 | 1.35 | 1.38 | 1.43 | 1.33 | 1.63 |
| Nb2O5 | 7.16 | 6.80 | 6.80 | 5.56 | 6.31 | 6.74 | 5.07 | 5.84 | 5.84 | 7.12 | 6.87 | 6.84 | 6.78 |
| Ta2O5 | 60.25 | 62.45 | 59.87 | 65.05 | 62.11 | 62.23 | 65.07 | 62.62 | 62.28 | 60.63 | 62.04 | 61.62 | 63.38 |
| SnO2 | 12.84 | 11.13 | 12.60 | 10.81 | 11.10 | 11.74 | 11.09 | 10.99 | 10.85 | 10.94 | 10.78 | 10.89 | 11.57 |
| WO3 | 4.96 | 3.40 | 4.67 | 2.27 | 4.23 | 3.04 | 2.57 | 4.31 | 4.74 | 4.44 | 4.71 | 4.83 | 2.77 |
| PbO | 0.02 | 0.02 | 0.00 | 0.08 | 0.01 | 0.01 | 0.00 | 0.01 | 0.08 | 0.00 | 0.02 | 0.00 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 |
| Sc2O3 | 0.15 | 0.06 | 0.18 | 0.07 | 0.09 | 0.23 | 0.07 | 0.10 | 0.05 | 0.18 | 0.09 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 |
| Total | 99.68 | 99.09 | 98.77 | 98.81 | 98.85 | 98.94 | 98.39 | 98.75 | 98.89 | 98.42 | 99.78 | 99.35 | 99.69 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.301 | 0.205 | 0.179 | 0.174 | 0.228 | 0.139 | 0.230 | 0.249 | 0.258 | 0.215 | 0.276 | 0.292 | 0.241 |
| Fe2+ | 1.830 | 1.914 | 2.036 | 1.999 | 2.004 | 2.042 | 1.940 | 2.016 | 1.989 | 2.046 | 2.019 | 1.928 | 1.922 |
| Mn | 1.867 | 1.879 | 1.784 | 1.818 | 1.767 | 1.818 | 1.830 | 1.735 | 1.744 | 1.738 | 1.703 | 1.779 | 1.826 |
| Fe3+ | 0.835 | 0.869 | 0.873 | 0.837 | 0.934 | 0.790 | 0.823 | 0.930 | 0.972 | 0.920 | 0.956 | 0.989 | 0.796 |
| Ti | 0.296 | 0.505 | 0.322 | 0.501 | 0.414 | 0.464 | 0.440 | 0.414 | 0.428 | 0.434 | 0.447 | 0.417 | 0.510 |
| Nb | 1.344 | 1.285 | 1.291 | 1.064 | 1.199 | 1.277 | 0.979 | 1.115 | 1.111 | 1.350 | 1.287 | 1.287 | 1.278 |
| Ta | 6.807 | 7.097 | 6.833 | 7.495 | 7.099 | 7.094 | 7.556 | 7.184 | 7.129 | 6.915 | 6.991 | 6.978 | 7.182 |
| Sn | 2.127 | 1.855 | 2.108 | 1.826 | 1.860 | 1.962 | 1.888 | 1.848 | 1.821 | 1.829 | 1.780 | 1.808 | 1.922 |
| W | 0.534 | 0.368 | 0.508 | 0.249 | 0.461 | 0.330 | 0.285 | 0.471 | 0.517 | 0.483 | 0.506 | 0.521 | 0.300 |
| Pb | 0.002 | 0.002 | 0.000 | 0.009 | 0.001 | 0.001 | 0.000 | 0.001 | 0.008 | 0.000 | 0.002 | 0.000 | 0.012 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.014 |
| Sc | 0.056 | 0.021 | 0.064 | 0.027 | 0.032 | 0.083 | 0.028 | 0.037 | 0.020 | 0.066 | 0.032 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: GC - GH & GZ1 - GZ14 same grain

contains inclusions of uranmicrolite

all ferrowodginite

**Pegmatite 5**

94-80E

| Raw data | XA | XC | XG | XH | XI | XJ | XK | XL | ZA | ZD | ZF | ZH | ZI | ZJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.88 | 8.87 | 9.36 | 9.57 | 10.55 | 8.01 | 9.04 | 9.49 | 10.36 | 10.97 | 11.44 | 11.85 | 9.58 | 9.35 |
| MnO | 3.85 | 8.55 | 8.44 | 5.22 | 3.86 | 6.91 | 7.39 | 8.67 | 8.03 | 4.02 | 3.72 | 3.94 | 4.01 | 7.26 |
| TiO2 | 2.47 | 1.80 | 1.84 | 2.53 | 2.05 | 2.03 | 1.97 | 1.50 | 1.15 | 1.57 | 1.52 | 1.40 | 1.77 | 1.50 |
| Nb2O5 | 17.94 | 17.97 | 17.15 | 21.02 | 14.20 | 15.57 | 14.21 | 15.60 | 16.57 | 15.28 | 13.96 | 12.61 | 13.01 | 20.50 |
| Ta2O5 | 50.99 | 44.55 | 46.19 | 45.66 | 55.21 | 50.32 | 47.88 | 40.80 | 32.37 | 48.74 | 47.90 | 44.60 | 51.02 | 42.30 |
| SnO2 | 8.22 | 4.85 | 5.40 | 6.91 | 10.33 | 6.91 | 7.94 | 5.66 | 4.32 | 10.47 | 11.40 | 10.57 | 10.58 | 4.61 |
| WO3 | 6.25 | 12.54 | 10.56 | 7.49 | 3.51 | 8.93 | 11.17 | 17.36 | 27.21 | 7.98 | 9.13 | 14.59 | 7.25 | 13.88 |
| PbO | 0.02 | 0.13 | 0.08 | 0.10 | 0.13 | 0.07 | 0.02 | 0.05 | 0.04 | 0.09 | 0.09 | 0.03 | 0.09 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.11 | 0.00 | 0.08 | 0.20 | 0.05 | 0.19 | 0.06 | 0.02 | 0.00 | 0.05 | 0.04 | 0.02 | 0.07 | 0.00 |
| Sc2O3 | 0.07 | 0.10 | 0.10 | 0.07 | 0.11 | 0.10 | 0.06 | 0.10 | 0.05 | 0.33 | 0.07 | 0.07 | 1.05 | 0.41 |
| Sb2O3 | 0.08 | 0.00 | 0.06 | 0.09 | 0.05 | 0.06 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Total | 100.88 | 99.36 | 99.26 | 98.90 | 100.05 | 99.10 | 99.82 | 99.31 | 100.09 | 99.49 | 99.28 | 99.70 | 98.43 | 99.92 |

| Recalculated<br>oxides | XA | XC | XG | XH | XI | XJ | XK | XL | ZA | ZD | ZF | ZH | ZI | ZJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.26 | 0.16 | 0.02 | 0.31 | 0.10 | 0.28 | 0.11 | 0.14 | 0.47 | 0.13 | 0.13 | 0.21 | 0.13 | 0.33 |
| FeO | 7.39 | 3.10 | 3.79 | 5.76 | 7.68 | 3.88 | 4.29 | 3.04 | 2.47 | 7.46 | 7.71 | 7.17 | 7.17 | 3.80 |
| MnO | 3.85 | 8.55 | 8.44 | 5.22 | 3.86 | 6.91 | 7.39 | 8.67 | 8.03 | 4.02 | 3.72 | 3.94 | 4.01 | 7.26 |
| Fe2O3 | 3.75 | 6.31 | 6.13 | 4.11 | 3.12 | 4.48 | 5.20 | 7.05 | 8.55 | 3.80 | 4.05 | 5.06 | 2.54 | 6.00 |
| TiO2 | 2.47 | 1.80 | 1.84 | 2.53 | 2.05 | 2.03 | 1.97 | 1.50 | 1.15 | 1.57 | 1.52 | 1.40 | 1.77 | 1.50 |
| Nb2O5 | 17.94 | 17.97 | 17.15 | 21.02 | 14.20 | 15.57 | 14.21 | 15.60 | 16.57 | 15.28 | 13.96 | 12.61 | 13.01 | 20.50 |
| Ta2O5 | 50.99 | 44.55 | 46.19 | 45.66 | 55.21 | 50.32 | 47.88 | 40.80 | 32.37 | 48.74 | 47.90 | 44.60 | 51.02 | 42.30 |
| SnO2 | 8.22 | 4.85 | 5.40 | 6.91 | 10.33 | 6.91 | 7.94 | 5.66 | 4.32 | 10.47 | 11.40 | 10.57 | 10.58 | 4.61 |
| WO3 | 6.25 | 12.54 | 10.56 | 7.49 | 3.51 | 8.93 | 11.17 | 17.36 | 27.21 | 7.98 | 9.13 | 14.59 | 7.25 | 13.88 |
| PbO | 0.02 | 0.13 | 0.08 | 0.10 | 0.13 | 0.07 | 0.02 | 0.05 | 0.04 | 0.09 | 0.09 | 0.03 | 0.09 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.11 | 0.00 | 0.08 | 0.20 | 0.05 | 0.19 | 0.06 | 0.02 | 0.00 | 0.05 | 0.04 | 0.02 | 0.07 | 0.00 |
| Sc2O3 | 0.07 | 0.10 | 0.10 | 0.07 | 0.11 | 0.10 | 0.06 | 0.10 | 0.05 | 0.33 | 0.07 | 0.07 | 1.05 | 0.41 |
| Sb2O3 | 0.08 | 0.00 | 0.06 | 0.09 | 0.05 | 0.06 | 0.06 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Total | 101.40 | 100.07 | 99.84 | 99.51 | 100.40 | 99.73 | 100.38 | 100.06 | 101.23 | 99.91 | 99.75 | 100.29 | 98.70 | 100.71 |

94-80E

**Structural formulae based on 32 oxygens**

| | XA | XC | XG | XH | XI | XJ | XK | XL | ZA | ZD | ZF | ZH | ZI | ZJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.397 | 0.249 | 0.036 | 0.481 | 0.156 | 0.441 | 0.179 | 0.219 | 0.713 | 0.210 | 0.201 | 0.334 | 0.208 | 0.504 |
| Fe2+ | 2.366 | 0.993 | 1.220 | 1.840 | 2.543 | 1.277 | 1.398 | 0.980 | 0.776 | 2.455 | 2.552 | 2.362 | 2.426 | 1.200 |
| Mn | 1.234 | 2.745 | 2.736 | 1.669 | 1.287 | 2.274 | 2.421 | 2.796 | 2.508 | 1.326 | 1.238 | 1.301 | 1.356 | 2.285 |
| Fe3+ | 1.078 | 1.819 | 1.776 | 1.180 | 0.929 | 1.325 | 1.526 | 2.042 | 2.419 | 1.125 | 1.207 | 1.500 | 0.773 | 1.706 |
| Ti | 0.703 | 0.513 | 0.530 | 0.718 | 0.607 | 0.593 | 0.573 | 0.430 | 0.318 | 0.459 | 0.449 | 0.411 | 0.532 | 0.419 |
| Nb | 3.070 | 3.079 | 2.967 | 3.586 | 2.526 | 2.735 | 2.485 | 2.686 | 2.764 | 2.694 | 2.480 | 2.221 | 2.348 | 3.445 |
| Ta | 5.249 | 4.592 | 4.807 | 4.686 | 5.909 | 5.317 | 5.036 | 4.225 | 3.246 | 5.170 | 5.118 | 4.726 | 5.540 | 4.276 |
| Sn | 1.241 | 0.733 | 0.824 | 1.040 | 1.621 | 1.071 | 1.225 | 0.859 | 0.635 | 1.628 | 1.787 | 1.642 | 1.685 | 0.683 |
| W | 0.613 | 1.232 | 1.047 | 0.733 | 0.358 | 0.899 | 1.120 | 1.713 | 2.601 | 0.806 | 0.930 | 1.473 | 0.750 | 1.337 |
| Pb | 0.002 | 0.013 | 0.008 | 0.010 | 0.014 | 0.007 | 0.002 | 0.005 | 0.004 | 0.009 | 0.010 | 0.003 | 0.010 | 0.011 |
| Th | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.009 | 0.000 | 0.007 | 0.017 | 0.004 | 0.016 | 0.005 | 0.002 | 0.000 | 0.004 | 0.003 | 0.002 | 0.006 | 0.000 |
| Sc | 0.023 | 0.033 | 0.033 | 0.023 | 0.038 | 0.034 | 0.020 | 0.033 | 0.016 | 0.113 | 0.024 | 0.025 | 0.366 | 0.134 |
| Sb | 0.012 | 0.000 | 0.009 | 0.014 | 0.008 | 0.010 | 0.010 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: XA - ZS from same grain - distribution of W is very patchy high W
contains zircon and microlite inclusions and partially encloses cassiterite

tungsteniferous wodginite and ferrowodginite

**Pegmatite 5**

94-80E

| Raw data | ZN | ZO | ZP | ZQ | ZR | ZS | YA | YB | YC | YD | YE | YF | QA | QB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 9.97 | 9.79 | 10.95 | 11.01 | 12.21 | 11.93 | 11.03 | 11.28 | 9.85 | 11.07 | 11.40 | 11.27 | 9.70 | 7.83 |
| MnO | 7.11 | 4.16 | 9.08 | 3.38 | 4.15 | 4.06 | 3.71 | 4.08 | 3.34 | 3.63 | 3.60 | 3.72 | 3.49 | 4.27 |
| TiO2 | 1.62 | 2.19 | 0.76 | 2.26 | 1.24 | 1.30 | 1.78 | 1.62 | 1.74 | 1.83 | 1.57 | 1.56 | 1.27 | 1.66 |
| Nb2O5 | 17.79 | 17.38 | 9.75 | 15.03 | 11.89 | 12.16 | 13.32 | 13.66 | 13.36 | 13.29 | 13.61 | 13.70 | 8.32 | 8.72 |
| Ta2O5 | 40.68 | 48.34 | 22.03 | 51.95 | 42.11 | 42.73 | 52.04 | 48.01 | 51.63 | 52.59 | 48.45 | 48.27 | 58.80 | 58.83 |
| SnO2 | 5.82 | 10.38 | 3.95 | 11.30 | 10.12 | 9.67 | 11.89 | 10.32 | 9.89 | 11.46 | 11.41 | 11.83 | 12.17 | 15.04 |
| WO3 | 17.78 | 5.37 | 43.78 | 4.46 | 17.96 | 17.39 | 6.37 | 10.69 | 7.30 | 6.63 | 9.91 | 9.89 | 5.63 | 0.93 |
| PbO | 0.04 | 0.04 | 0.05 | 0.09 | 0.09 | 0.01 | 0.01 | 0.09 | 0.06 | 0.12 | 0.02 | 0.04 | 0.00 | 0.68 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.75 | 0.00 | 0.06 | 0.00 | 0.09 | 0.03 | 0.15 | 0.70 | 0.14 | 0.34 | 0.19 | 0.00 | 0.48 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| Total | 100.93 | 98.40 | 100.34 | 99.53 | 99.77 | 99.34 | 100.19 | 99.89 | 98.04 | 100.75 | 100.32 | 100.46 | 99.38 | 98.43 |

94-80E

| Recalculated oxides | ZN | ZO | ZP | ZQ | ZR | ZS | YA | YB | YC | YD | YE | YF | QA | QB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.36 | 0.13 | 0.63 | 0.10 | 0.24 | 0.28 | 0.11 | 0.17 | 0.25 | 0.12 | 0.15 | 0.16 | 0.22 | 0.01 |
| FeO | 3.90 | 7.35 | 0.64 | 8.22 | 6.82 | 6.74 | 7.85 | 7.23 | 7.23 | 7.89 | 7.84 | 7.68 | 6.99 | 6.81 |
| MnO | 7.11 | 4.16 | 9.08 | 3.38 | 4.15 | 4.06 | 3.71 | 4.08 | 3.34 | 3.63 | 3.60 | 3.72 | 3.49 | 4.27 |
| Fe2O3 | 6.57 | 2.60 | 11.15 | 3.04 | 5.84 | 5.61 | 3.45 | 4.39 | 2.76 | 3.44 | 3.84 | 3.88 | 2.93 | 1.10 |
| TiO2 | 1.62 | 2.19 | 0.76 | 2.26 | 1.24 | 1.30 | 1.78 | 1.62 | 1.74 | 1.83 | 1.57 | 1.56 | 1.27 | 1.66 |
| Nb2O5 | 17.79 | 17.38 | 9.75 | 15.03 | 11.89 | 12.16 | 13.32 | 13.66 | 13.36 | 13.29 | 13.61 | 13.70 | 8.32 | 8.72 |
| Ta2O5 | 40.68 | 48.34 | 22.03 | 51.95 | 42.11 | 42.73 | 52.04 | 48.01 | 51.63 | 52.59 | 48.45 | 48.27 | 58.80 | 58.83 |
| SnO2 | 5.82 | 10.38 | 3.95 | 11.30 | 10.12 | 9.67 | 11.89 | 10.32 | 9.89 | 11.46 | 11.41 | 11.83 | 12.17 | 15.04 |
| WO3 | 17.78 | 5.37 | 43.78 | 4.46 | 17.96 | 17.39 | 6.37 | 10.69 | 7.30 | 6.63 | 9.91 | 9.89 | 5.63 | 0.93 |
| PbO | 0.04 | 0.04 | 0.05 | 0.09 | 0.09 | 0.01 | 0.01 | 0.09 | 0.06 | 0.12 | 0.02 | 0.04 | 0.00 | 0.68 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.75 | 0.00 | 0.06 | 0.00 | 0.09 | 0.03 | 0.15 | 0.70 | 0.14 | 0.34 | 0.19 | 0.00 | 0.48 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 |
| Total | 101.79 | 98.69 | 101.80 | 99.88 | 100.45 | 100.04 | 100.57 | 100.40 | 98.49 | 101.14 | 100.74 | 100.94 | 99.81 | 98.52 |

**Structural formulae based on 32 oxygens**

| | ZN | ZO | ZP | ZQ | ZR | ZS | YA | YB | YC | YD | YE | YF | QA | QB |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.539 | 0.206 | 0.954 | 0.163 | 0.385 | 0.437 | 0.167 | 0.269 | 0.409 | 0.189 | 0.237 | 0.255 | 0.367 | 0.017 |
| Fe2+ | 1.226 | 2.419 | 0.202 | 2.707 | 2.240 | 2.222 | 2.595 | 2.376 | 2.453 | 2.598 | 2.574 | 2.517 | 2.419 | 2.395 |
| Mn | 2.231 | 1.371 | 2.839 | 1.121 | 1.366 | 1.340 | 1.236 | 1.346 | 1.132 | 1.200 | 1.187 | 1.225 | 1.214 | 1.512 |
| Fe3+ | 1.861 | 0.769 | 3.179 | 0.901 | 1.727 | 1.664 | 1.027 | 1.299 | 0.843 | 1.019 | 1.135 | 1.144 | 0.911 | 0.347 |
| Ti | 0.451 | 0.641 | 0.212 | 0.664 | 0.363 | 0.382 | 0.526 | 0.475 | 0.525 | 0.537 | 0.459 | 0.454 | 0.391 | 0.523 |
| Nb | 2.981 | 3.061 | 1.627 | 2.662 | 2.087 | 2.140 | 2.366 | 2.406 | 2.416 | 2.348 | 2.394 | 2.406 | 1.543 | 1.650 |
| Ta | 4.098 | 5.120 | 2.212 | 5.535 | 4.448 | 4.525 | 5.560 | 5.086 | 5.617 | 5.590 | 5.126 | 5.099 | 6.563 | 6.695 |
| Sn | 0.860 | 1.612 | 0.581 | 1.765 | 1.568 | 1.502 | 1.863 | 1.603 | 1.578 | 1.786 | 1.770 | 1.832 | 1.993 | 2.510 |
| W | 1.707 | 0.542 | 4.189 | 0.453 | 1.808 | 1.755 | 0.649 | 1.079 | 0.757 | 0.671 | 1.000 | 0.995 | 0.599 | 0.101 |
| Pb | 0.004 | 0.004 | 0.005 | 0.009 | 0.009 | 0.001 | 0.001 | 0.009 | 0.006 | 0.013 | 0.002 | 0.004 | 0.000 | 0.076 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.041 | 0.256 | 0.000 | 0.020 | 0.000 | 0.030 | 0.010 | 0.052 | 0.243 | 0.049 | 0.116 | 0.064 | 0.000 | 0.174 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | | | high W | | | | | | | | | | attached to cass. | incl. in cass. |

XA - ZS from same grain - distribution of W is very patchy

contains zircon and microlite inclusions and partially encloses cassiterite

tungsteniferous wodginite and ferrowodginite

**Pegmatite 5**

94-80E

| Raw data | QC | QF | QH | QS | RA | RB | RC | RD | RE | RF | RG | RH | RJ | RK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 10.46 | 8.62 | 7.81 | 11.06 | 8.92 | 9.04 | 10.74 | 10.01 | 9.76 | 9.48 | 8.44 | 9.08 | 9.49 | 9.79 |
| MnO | 3.70 | 3.46 | 4.29 | 3.86 | 7.61 | 8.24 | 7.38 | 7.71 | 7.17 | 6.72 | 7.37 | 7.14 | 7.70 | 7.51 |
| TiO2 | 1.14 | 1.78 | 2.32 | 1.23 | 1.46 | 1.39 | 1.10 | 1.35 | 1.51 | 1.39 | 1.79 | 1.87 | 1.43 | 1.30 |
| Nb2O5 | 11.60 | 7.59 | 7.45 | 11.98 | 16.98 | 15.49 | 13.24 | 16.28 | 17.88 | 17.18 | 13.42 | 12.22 | 17.86 | 17.95 |
| Ta2O5 | 39.56 | 60.71 | 63.84 | 41.69 | 41.32 | 39.02 | 31.07 | 36.54 | 38.32 | 35.63 | 43.83 | 43.23 | 40.08 | 35.35 |
| SnO2 | 8.22 | 14.99 | 11.33 | 9.38 | 5.41 | 5.21 | 5.38 | 4.81 | 5.33 | 6.06 | 8.40 | 8.15 | 4.70 | 3.85 |
| WO3 | 21.05 | 1.92 | 0.77 | 18.14 | 17.36 | 21.10 | 30.12 | 21.54 | 19.22 | 20.63 | 16.18 | 18.04 | 18.44 | 22.73 |
| PbO | 0.48 | 0.00 | 0.56 | 0.67 | 0.04 | 0.08 | 0.10 | 0.11 | 0.03 | 0.08 | 0.09 | 0.06 | 0.13 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.17 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.25 | 0.83 | 0.42 | 0.38 | 0.22 | 0.13 | 0.17 | 0.21 | 0.73 | 1.18 | 0.28 | 0.12 | 0.14 | 0.73 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.59 | 0.34 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Total | 96.51 | 100.48 | 99.28 | 98.78 | 99.31 | 99.69 | 99.28 | 98.56 | 99.96 | 98.35 | 99.80 | 99.91 | 99.99 | 99.33 |
| Recalculated | | | | | | | 94-80E | | | | | | | |
| oxides | QC | QF | QH | QS | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E | 94-80E |
| Li2O | 0.55 | 0.02 | 0.09 | 0.34 | 0.38 | 0.38 | 0.47 | 0.32 | 0.33 | 0.33 | 0.28 | 0.29 | 0.37 | 0.41 |
| FeO | 5.28 | 7.94 | 6.46 | 6.25 | 3.04 | 2.41 | 2.86 | 3.15 | 3.90 | 4.10 | 3.52 | 3.70 | 3.09 | 3.14 |
| MnO | 3.70 | 3.46 | 4.29 | 3.86 | 7.61 | 8.24 | 7.38 | 7.71 | 7.17 | 6.72 | 7.37 | 7.14 | 7.70 | 7.51 |
| Fe2O3 | 5.52 | 0.68 | 1.43 | 5.14 | 6.37 | 7.20 | 8.51 | 7.44 | 6.32 | 5.76 | 5.34 | 5.84 | 6.94 | 7.16 |
| TiO2 | 1.14 | 1.78 | 2.32 | 1.23 | 1.46 | 1.39 | 1.10 | 1.35 | 1.51 | 1.39 | 1.79 | 1.87 | 1.43 | 1.30 |
| Nb2O5 | 11.60 | 7.59 | 7.45 | 11.98 | 16.98 | 15.49 | 13.24 | 16.28 | 17.88 | 17.18 | 13.42 | 12.22 | 17.86 | 17.95 |
| Ta2O5 | 39.56 | 60.71 | 63.84 | 41.69 | 41.32 | 39.02 | 31.07 | 36.54 | 38.32 | 35.63 | 43.83 | 43.23 | 40.08 | 35.35 |
| SnO2 | 8.22 | 14.99 | 11.33 | 9.38 | 5.41 | 5.21 | 5.38 | 4.81 | 5.33 | 6.06 | 8.40 | 8.15 | 4.70 | 3.85 |
| WO3 | 21.05 | 1.92 | 0.77 | 18.14 | 17.36 | 21.10 | 30.12 | 21.54 | 19.22 | 20.63 | 16.18 | 18.04 | 18.44 | 22.73 |
| PbO | 0.48 | 0.00 | 0.56 | 0.67 | 0.04 | 0.08 | 0.10 | 0.11 | 0.03 | 0.08 | 0.09 | 0.06 | 0.13 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.17 | 0.21 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.25 | 0.83 | 0.42 | 0.38 | 0.22 | 0.13 | 0.17 | 0.21 | 0.73 | 1.18 | 0.28 | 0.12 | 0.14 | 0.73 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.59 | 0.34 | 0.17 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Total | 97.41 | 100.50 | 99.46 | 99.45 | 100.18 | 100.64 | 100.38 | 99.47 | 100.74 | 99.06 | 100.50 | 100.66 | 100.90 | 100.25 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | | |
| Li | 0.898 | 0.037 | 0.149 | 0.548 | 0.582 | 0.588 | 0.721 | 0.502 | 0.499 | 0.514 | 0.441 | 0.456 | 0.570 | 0.625 |
| Fe2+ | 1.798 | 2.757 | 2.272 | 2.092 | 0.976 | 0.773 | 0.918 | 1.015 | 1.236 | 1.324 | 1.148 | 1.209 | 0.981 | 0.998 |
| Mn | 1.252 | 1.207 | 1.517 | 1.288 | 2.438 | 2.631 | 2.351 | 2.471 | 2.261 | 2.153 | 2.402 | 2.329 | 2.437 | 2.365 |
| Fe3+ | 1.692 | 0.211 | 0.453 | 1.550 | 1.844 | 2.077 | 2.461 | 2.154 | 1.803 | 1.676 | 1.567 | 1.715 | 1.983 | 2.046 |
| Ti | 0.342 | 0.552 | 0.726 | 0.364 | 0.414 | 0.394 | 0.311 | 0.386 | 0.422 | 0.394 | 0.519 | 0.541 | 0.401 | 0.363 |
| Nb | 2.094 | 1.413 | 1.405 | 2.133 | 2.902 | 2.640 | 2.252 | 2.787 | 3.011 | 2.938 | 2.334 | 2.127 | 3.015 | 3.018 |
| Ta | 4.294 | 6.799 | 7.243 | 4.464 | 4.249 | 4.001 | 3.178 | 3.764 | 3.880 | 3.666 | 4.585 | 4.526 | 4.070 | 3.575 |
| Sn | 1.308 | 2.462 | 1.884 | 1.472 | 0.816 | 0.784 | 0.807 | 0.727 | 0.791 | 0.914 | 1.288 | 1.251 | 0.700 | 0.571 |
| W | 2.177 | 0.205 | 0.084 | 1.851 | 1.701 | 2.062 | 2.937 | 2.114 | 1.855 | 2.022 | 1.613 | 1.800 | 1.784 | 2.191 |
| Pb | 0.052 | 0.000 | 0.063 | 0.071 | 0.004 | 0.008 | 0.010 | 0.011 | 0.003 | 0.008 | 0.009 | 0.007 | 0.013 | 0.012 |
| Th | 0.000 | 0.000 | 0.016 | 0.019 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.088 | 0.296 | 0.153 | 0.129 | 0.073 | 0.043 | 0.055 | 0.070 | 0.237 | 0.390 | 0.094 | 0.039 | 0.045 | 0.236 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.062 | 0.036 | 0.018 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | | incl. in cass. | incl. in cass. | | | | high W | | | | | | | |

QC - QS mottled crystal attached to cassiterite

tungsteniferous wodginite and ferrowodginite

| | **Pegmatite 5** | | | | **Pegmatite 5** | | | | **Pegmatite 5** | | **Pegmatite 5** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-80E | | | | 94-80F | | | | 94-80G | | 94-80J | |
| **Raw data** | RL | RM | ZC | ZG | ZH | ZI | ZJ | ZK | NE | NF | AA | AB |
| FeO | 9.92 | 9.18 | 9.29 | 9.31 | 8.58 | 9.89 | 8.93 | 8.92 | 10.08 | 9.96 | 7.89 | 8.28 |
| MnO | 7.55 | 6.20 | 4.93 | 4.83 | 4.87 | 4.89 | 4.89 | 4.97 | 4.46 | 4.52 | 4.89 | 4.82 |
| TiO2 | 1.45 | 2.16 | 1.62 | 1.35 | 0.52 | 1.16 | 0.60 | 1.31 | 3.08 | 3.01 | 1.74 | 1.91 |
| Nb2O5 | 13.93 | 14.51 | 12.75 | 12.08 | 7.54 | 11.56 | 7.50 | 11.32 | 11.87 | 12.59 | 8.95 | 10.12 |
| Ta2O5 | 36.98 | 45.82 | 56.92 | 56.02 | 61.10 | 54.63 | 61.10 | 57.85 | 55.79 | 54.62 | 61.42 | 59.71 |
| SnO2 | 6.15 | 8.33 | 12.42 | 12.79 | 15.09 | 12.56 | 14.14 | 13.37 | 10.59 | 10.99 | 13.31 | 12.31 |
| WO3 | 24.14 | 12.85 | 1.37 | 2.09 | 1.55 | 3.23 | 2.00 | 1.28 | 2.71 | 2.90 | 1.64 | 2.13 |
| PbO | 0.05 | 0.06 | 0.13 | 0.12 | 0.10 | 0.12 | 0.05 | 0.05 | 0.12 | 0.08 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.09 | 0.08 | 0.14 | 0.17 | 0.03 | 0.11 | 0.18 | 0.17 | 0.00 | 0.00 |
| Sc2O3 | 0.17 | 0.31 | | | | | | | 0.16 | 0.18 | 0.13 | 0.05 |
| Sb2O3 | 0.00 | 0.00 | | | | | | | 0.02 | 0.03 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | | | | | | | | | 0.00 | 0.00 |
| Total | 100.33 | 99.42 | 99.52 | 98.67 | 99.49 | 98.22 | 99.24 | 99.18 | 99.07 | 99.05 | 99.97 | 99.32 |
| Recalculated | 94-80E | | | | 94-80F | | | | 94-80G | | 94-80J | |
| oxides | 94-80E | 94-80E | ZC | ZG | ZH | ZI | ZJ | ZK | NE | NF | AA | AB |
| Li2O | 0.39 | 0.24 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.13 |
| FeO | 3.10 | 4.86 | 6.83 | 6.78 | 6.45 | 6.87 | 6.49 | 6.65 | 7.58 | 7.53 | 6.15 | 6.21 |
| MnO | 7.55 | 6.20 | 4.93 | 4.83 | 4.87 | 4.89 | 4.89 | 4.97 | 4.46 | 4.52 | 4.89 | 4.82 |
| Fe2O3 | 7.38 | 4.68 | 2.71 | 2.79 | 2.34 | 3.32 | 2.69 | 2.50 | 2.74 | 2.66 | 1.88 | 2.24 |
| TiO2 | 1.45 | 2.16 | 1.62 | 1.35 | 0.52 | 1.16 | 0.60 | 1.31 | 3.08 | 3.01 | 1.74 | 1.91 |
| Nb2O5 | 13.93 | 14.51 | 12.75 | 12.08 | 7.54 | 11.56 | 7.50 | 11.32 | 11.87 | 12.59 | 8.95 | 10.12 |
| Ta2O5 | 36.98 | 45.82 | 56.92 | 56.02 | 61.10 | 54.63 | 61.10 | 57.85 | 55.79 | 54.62 | 61.42 | 59.71 |
| SnO2 | 6.15 | 8.33 | 12.42 | 12.79 | 15.09 | 12.56 | 14.14 | 13.37 | 10.59 | 10.99 | 13.31 | 12.31 |
| WO3 | 24.14 | 12.85 | 1.37 | 2.09 | 1.55 | 3.23 | 2.00 | 1.28 | 2.71 | 2.90 | 1.64 | 2.13 |
| PbO | 0.05 | 0.06 | 0.13 | 0.12 | 0.10 | 0.12 | 0.05 | 0.05 | 0.12 | 0.08 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.09 | 0.08 | 0.14 | 0.17 | 0.03 | 0.11 | 0.18 | 0.17 | 0.00 | 0.00 |
| Sc2O3 | 0.17 | 0.31 | | | | | | | 0.16 | 0.18 | 0.13 | 0.05 |
| Sb2O3 | 0.00 | 0.00 | | | | | | | 0.02 | 0.03 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | | | | | | | | | 0.00 | 0.00 |
| Total | 101.28 | 100.02 | 99.77 | 98.93 | 99.71 | 98.52 | 99.49 | 99.41 | 99.31 | 99.28 | 100.22 | 99.62 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | |
| Li | 0.604 | 0.383 | 0.004 | 0.007 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.191 | 0.207 |
| Fe2+ | 0.991 | 1.586 | 2.302 | 2.314 | 2.266 | 2.358 | 2.278 | 2.273 | 2.540 | 2.515 | 2.116 | 2.130 |
| Mn | 2.400 | 2.025 | 1.680 | 1.666 | 1.729 | 1.694 | 1.735 | 1.718 | 1.509 | 1.523 | 1.693 | 1.663 |
| Fe3+ | 2.123 | 1.374 | 0.823 | 0.856 | 0.741 | 1.025 | 0.850 | 0.771 | 0.828 | 0.799 | 0.583 | 0.690 |
| Ti | 0.410 | 0.626 | 0.490 | 0.413 | 0.164 | 0.357 | 0.189 | 0.402 | 0.925 | 0.901 | 0.535 | 0.585 |
| Nb | 2.365 | 2.529 | 2.318 | 2.224 | 1.429 | 2.137 | 1.420 | 2.088 | 2.144 | 2.265 | 1.656 | 1.865 |
| Ta | 3.777 | 4.803 | 6.226 | 6.203 | 6.964 | 6.075 | 6.960 | 6.419 | 6.060 | 5.910 | 6.834 | 6.617 |
| Sn | 0.921 | 1.280 | 1.992 | 2.076 | 2.522 | 2.048 | 2.362 | 2.175 | 1.687 | 1.744 | 2.171 | 2.001 |
| W | 2.350 | 1.284 | 0.143 | 0.221 | 0.168 | 0.342 | 0.217 | 0.135 | 0.281 | 0.299 | 0.174 | 0.225 |
| Pb | 0.005 | 0.006 | 0.014 | 0.013 | 0.011 | 0.013 | 0.006 | 0.005 | 0.013 | 0.009 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.008 | 0.007 | 0.013 | 0.015 | 0.003 | 0.010 | 0.016 | 0.015 | 0.000 | 0.000 |
| Sc | 0.056 | 0.102 | | | | | | | 0.056 | 0.062 | 0.046 | 0.016 |
| Sb | 0.000 | 0.000 | | | | | | | 0.003 | 0.005 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | | | | | | | | | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.006 | 16.064 | 16.018 | 16.000 | 16.061 | 16.047 | 16.000 | 16.000 |
| Comments: | | | ZC & ZG same grain | | | | | | | | | |
| | | | | | complex ferrowodginite-cassiterite-uranmicrolite | | | | | | | |
| | | | | | grain associated with arsenopyrite | | | | | | | |
| | tungsteniferous | | | | | | | | | | | |
| | wodginite | | | | all ferrowodginite | | | | ferrowodginite | | ferrowodginite | |

| | | | **Pegmatite 5** | | | | | **Pegmatite 5** | | | | **Pegmatite 5** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94-80J | | | | | 94-80K | | | | 94-80L | |
| Raw data | AC | AD | AE | AF | AG | RA | RB | RC | RD | RE | BB | BD | BE |
| FeO | 8.03 | 7.44 | 8.06 | 8.00 | 7.85 | 8.32 | 7.36 | 8.40 | 8.37 | 8.33 | 9.97 | 9.45 | 10.34 |
| MnO | 4.64 | 5.46 | 4.67 | 4.72 | 4.61 | 5.19 | 5.37 | 4.67 | 4.77 | 4.72 | 3.55 | 3.77 | 3.38 |
| TiO2 | 1.04 | 1.68 | 1.43 | 1.51 | 0.98 | 1.57 | 0.88 | 1.44 | 1.19 | 1.31 | 2.43 | 1.86 | 1.83 |
| Nb2O5 | 8.14 | 9.40 | 8.60 | 8.93 | 7.54 | 10.09 | 5.71 | 6.74 | 5.68 | 6.21 | 9.31 | 9.23 | 9.87 |
| Ta2O5 | 61.77 | 58.69 | 61.14 | 60.76 | 61.94 | 57.26 | 64.54 | 59.95 | 63.67 | 62.92 | 59.94 | 59.74 | 56.79 |
| SnO2 | 14.90 | 13.49 | 14.14 | 13.89 | 14.81 | 11.93 | 13.48 | 12.28 | 12.03 | 12.27 | 11.32 | 12.03 | 9.36 |
| WO3 | 1.90 | 2.91 | 1.41 | 2.00 | 2.05 | 4.38 | 2.42 | 4.93 | 3.20 | 2.71 | 3.63 | 3.18 | 7.13 |
| PbO | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.04 | 0.02 | 0.04 | 0.04 | 0.05 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 |
| Sc2O3 | 0.17 | 0.11 | 0.01 | 0.07 | 0.11 | 0.08 | 0.10 | 0.07 | 0.00 | 0.09 | 0.27 | 0.15 | 0.21 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.58 | 99.23 | 99.46 | 99.87 | 99.88 | 98.87 | 99.86 | 98.52 | 98.93 | 98.59 | 100.45 | 99.46 | 99.10 |
| Recalculated | | | 94-80J | | | | | 94-80K | | | | 94-80L | |
| oxides | AC | AD | AE | AF | AG | RA | RB | RC | RD | RE | BB | BD | BE |
| Li2O | 0.11 | 0.12 | 0.10 | 0.13 | 0.13 | 0.14 | 0.13 | 0.15 | 0.12 | 0.09 | 0.10 | 0.12 | 0.24 |
| FeO | 6.37 | 5.52 | 6.32 | 6.22 | 6.17 | 5.74 | 5.30 | 5.93 | 5.89 | 6.06 | 7.75 | 7.24 | 7.16 |
| MnO | 4.64 | 5.46 | 4.67 | 4.72 | 4.61 | 5.19 | 5.37 | 4.67 | 4.77 | 4.72 | 3.55 | 3.77 | 3.38 |
| Fe2O3 | 1.80 | 2.08 | 1.89 | 1.93 | 1.82 | 2.80 | 2.23 | 2.69 | 2.70 | 2.47 | 2.39 | 2.38 | 3.40 |
| TiO2 | 1.04 | 1.68 | 1.43 | 1.51 | 0.98 | 1.57 | 0.88 | 1.44 | 1.19 | 1.31 | 2.43 | 1.86 | 1.83 |
| Nb2O5 | 8.14 | 9.40 | 8.60 | 8.93 | 7.54 | 10.09 | 5.71 | 6.74 | 5.68 | 6.21 | 9.31 | 9.23 | 9.87 |
| Ta2O5 | 61.77 | 58.69 | 61.14 | 60.76 | 61.94 | 57.26 | 64.54 | 59.95 | 63.67 | 62.92 | 59.94 | 59.74 | 56.79 |
| SnO2 | 14.90 | 13.49 | 14.14 | 13.89 | 14.81 | 11.93 | 13.48 | 12.28 | 12.03 | 12.27 | 11.32 | 12.03 | 9.36 |
| WO3 | 1.90 | 2.91 | 1.41 | 2.00 | 2.05 | 4.38 | 2.42 | 4.93 | 3.20 | 2.71 | 3.63 | 3.18 | 7.13 |
| PbO | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.04 | 0.02 | 0.04 | 0.04 | 0.05 | 0.02 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 |
| Sc2O3 | 0.17 | 0.11 | 0.01 | 0.07 | 0.11 | 0.08 | 0.10 | 0.07 | 0.00 | 0.09 | 0.27 | 0.15 | 0.21 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.82 | 99.51 | 99.71 | 100.15 | 100.15 | 99.23 | 100.16 | 98.88 | 99.27 | 98.89 | 100.72 | 99.76 | 99.56 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.184 | 0.196 | 0.169 | 0.215 | 0.222 | 0.226 | 0.215 | 0.256 | 0.204 | 0.157 | 0.163 | 0.200 | 0.390 |
| Fe2+ | 2.201 | 1.903 | 2.195 | 2.147 | 2.157 | 1.975 | 1.874 | 2.087 | 2.091 | 2.150 | 2.624 | 2.490 | 2.450 |
| Mn | 1.615 | 1.894 | 1.635 | 1.639 | 1.621 | 1.794 | 1.911 | 1.653 | 1.702 | 1.688 | 1.208 | 1.305 | 1.158 |
| Fe3+ | 0.559 | 0.646 | 0.592 | 0.598 | 0.571 | 0.867 | 0.709 | 0.851 | 0.863 | 0.789 | 0.728 | 0.738 | 1.047 |
| Ti | 0.320 | 0.518 | 0.443 | 0.464 | 0.305 | 0.481 | 0.278 | 0.451 | 0.377 | 0.414 | 0.735 | 0.573 | 0.555 |
| Nb | 1.513 | 1.741 | 1.607 | 1.655 | 1.415 | 1.863 | 1.083 | 1.274 | 1.083 | 1.185 | 1.693 | 1.704 | 1.804 |
| Ta | 6.905 | 6.541 | 6.872 | 6.775 | 6.997 | 6.356 | 7.371 | 6.816 | 7.303 | 7.220 | 6.557 | 6.636 | 6.247 |
| Sn | 2.441 | 2.205 | 2.331 | 2.271 | 2.453 | 1.942 | 2.258 | 2.047 | 2.023 | 2.064 | 1.815 | 1.959 | 1.510 |
| W | 0.202 | 0.309 | 0.151 | 0.213 | 0.221 | 0.463 | 0.264 | 0.534 | 0.350 | 0.296 | 0.378 | 0.337 | 0.748 |
| Pb | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.005 | 0.003 | 0.005 | 0.005 | 0.005 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.017 |
| Sc | 0.060 | 0.040 | 0.005 | 0.023 | 0.039 | 0.029 | 0.037 | 0.027 | 0.000 | 0.032 | 0.093 | 0.054 | 0.073 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | | | | AF & AG<br>same grain | | RA - RD same grain | | | | | | BD & BE<br>same grain | |
| | | | all ferrowodginite | | | | | all ferrowodginite | | | | all ferrowodginite | |

**Pegmatite 5**

94-80P

| Raw data | MD | ME | MF | MM | MP | MQ | MR | MW | MX | MY | NA | NE | NF | NG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 8.74 | 9.13 | 8.97 | 9.30 | 9.43 | 9.32 | 9.24 | 9.40 | 9.39 | 9.27 | 8.39 | 7.98 | 8.38 | 8.47 |
| MnO | 4.75 | 4.75 | 5.46 | 4.60 | 4.97 | 5.04 | 4.66 | 4.88 | 4.91 | 4.85 | 4.89 | 5.89 | 5.35 | 5.51 |
| TiO2 | 1.44 | 1.06 | 0.89 | 1.49 | 1.18 | 1.40 | 1.37 | 1.48 | 1.76 | 1.67 | 1.94 | 0.81 | 1.12 | 0.92 |
| Nb2O5 | 8.80 | 7.81 | 7.32 | 7.42 | 8.07 | 8.56 | 7.42 | 8.42 | 8.30 | 8.95 | 5.72 | 6.61 | 7.13 | 7.45 |
| Ta2O5 | 60.21 | 61.48 | 57.71 | 61.44 | 58.30 | 58.43 | 60.22 | 58.69 | 59.15 | 57.35 | 66.30 | 60.01 | 61.51 | 59.07 |
| SnO2 | 12.77 | 12.56 | 12.06 | 11.98 | 12.31 | 11.34 | 12.52 | 11.01 | 11.37 | 11.76 | 11.44 | 12.79 | 12.78 | 12.27 |
| WO3 | 3.45 | 3.65 | 7.15 | 3.40 | 4.39 | 5.04 | 3.88 | 4.75 | 4.76 | 4.83 | 0.54 | 5.49 | 3.01 | 5.58 |
| PbO | 0.32 | 0.00 | 0.42 | 0.00 | 0.07 | 0.03 | 0.19 | 0.00 | 0.10 | 0.36 | 0.00 | 0.00 | 0.26 | 0.18 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.18 | 0.43 | 0.39 | 0.00 | 0.04 | 0.00 | 0.18 | 0.00 | 0.10 | 0.55 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.39 | 0.00 | 0.23 | 0.75 | 0.45 | 0.63 | 0.00 | 0.56 | 0.00 | 0.00 | 0.99 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.34 | 0.27 | 0.00 | 0.00 | 0.32 | 0.46 | 0.00 | 0.19 | 0.00 | 0.23 | 0.00 | 0.13 | 0.00 |
| Total | 100.48 | 100.79 | 100.27 | 100.20 | 99.14 | 100.11 | 100.71 | 99.12 | 100.56 | 99.23 | 100.01 | 99.67 | 100.22 | 100.43 |

Recalculated

94-80P

| oxides | MD | ME | MF | MM | MP | MQ | MR | MW | MX | MY | NA | NE | NF | NG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.11 | 0.07 | 0.08 | 0.01 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.05 | 0.00 | 0.10 | 0.03 | 0.00 |
| FeO | 6.28 | 6.47 | 5.58 | 6.90 | 6.48 | 6.45 | 7.06 | 6.61 | 6.84 | 6.38 | 6.63 | 5.04 | 5.87 | 6.04 |
| MnO | 4.75 | 4.75 | 5.46 | 4.60 | 4.97 | 5.04 | 4.66 | 4.88 | 4.91 | 4.85 | 4.89 | 5.89 | 5.35 | 5.51 |
| Fe2O3 | 2.68 | 2.90 | 3.71 | 2.61 | 3.25 | 3.13 | 2.34 | 3.04 | 2.76 | 3.17 | 1.90 | 3.22 | 2.75 | 2.62 |
| TiO2 | 1.44 | 1.06 | 0.89 | 1.49 | 1.18 | 1.40 | 1.37 | 1.48 | 1.76 | 1.67 | 1.94 | 0.81 | 1.12 | 0.92 |
| Nb2O5 | 8.80 | 7.81 | 7.32 | 7.42 | 8.07 | 8.56 | 7.42 | 8.42 | 8.30 | 8.95 | 5.72 | 6.61 | 7.13 | 7.45 |
| Ta2O5 | 60.21 | 61.48 | 57.71 | 61.44 | 58.30 | 58.43 | 60.22 | 58.69 | 59.15 | 57.35 | 66.30 | 60.01 | 61.51 | 59.07 |
| SnO2 | 12.77 | 12.56 | 12.06 | 11.98 | 12.31 | 11.34 | 12.52 | 11.01 | 11.37 | 11.76 | 11.44 | 12.79 | 12.78 | 12.27 |
| WO3 | 3.45 | 3.65 | 7.15 | 3.40 | 4.39 | 5.04 | 3.88 | 4.75 | 4.76 | 4.83 | 0.54 | 5.49 | 3.01 | 5.58 |
| PbO | 0.32 | 0.00 | 0.42 | 0.00 | 0.07 | 0.03 | 0.19 | 0.00 | 0.10 | 0.36 | 0.00 | 0.00 | 0.26 | 0.18 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.18 | 0.43 | 0.39 | 0.00 | 0.04 | 0.00 | 0.18 | 0.00 | 0.10 | 0.55 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.39 | 0.00 | 0.23 | 0.75 | 0.45 | 0.63 | 0.00 | 0.56 | 0.00 | 0.00 | 0.99 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.34 | 0.27 | 0.00 | 0.00 | 0.32 | 0.46 | 0.00 | 0.19 | 0.00 | 0.23 | 0.00 | 0.13 | 0.00 |
| Total | 100.81 | 101.11 | 100.66 | 100.42 | 99.43 | 100.40 | 100.87 | 99.38 | 100.77 | 99.56 | 100.15 | 100.05 | 100.49 | 100.62 |

**Structural formulae based on 32 oxygens**

| | MD | ME | MF | MM | MP | MQ | MR | MW | MX | MY | NA | NE | NF | NG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.177 | 0.120 | 0.126 | 0.014 | 0.000 | 0.040 | 0.000 | 0.017 | 0.000 | 0.081 | 0.000 | 0.170 | 0.045 | 0.000 |
| Fe2+ | 2.150 | 2.230 | 1.929 | 2.385 | 2.250 | 2.213 | 2.436 | 2.286 | 2.334 | 2.197 | 2.327 | 1.760 | 2.046 | 2.086 |
| Mn | 1.638 | 1.650 | 1.899 | 1.601 | 1.742 | 1.743 | 1.616 | 1.697 | 1.685 | 1.683 | 1.729 | 2.070 | 1.880 | 1.910 |
| Fe3+ | 0.828 | 0.899 | 1.154 | 0.811 | 1.016 | 0.968 | 0.728 | 0.945 | 0.849 | 0.982 | 0.601 | 1.011 | 0.863 | 0.814 |
| Ti | 0.440 | 0.328 | 0.275 | 0.462 | 0.367 | 0.431 | 0.421 | 0.457 | 0.537 | 0.514 | 0.609 | 0.253 | 0.350 | 0.283 |
| Nb | 1.620 | 1.447 | 1.360 | 1.380 | 1.511 | 1.581 | 1.373 | 1.564 | 1.519 | 1.658 | 1.079 | 1.241 | 1.338 | 1.378 |
| Ta | 6.672 | 6.850 | 6.445 | 6.868 | 6.564 | 6.489 | 6.705 | 6.559 | 6.517 | 6.392 | 7.523 | 6.777 | 6.945 | 6.576 |
| Sn | 2.076 | 2.052 | 1.975 | 1.963 | 2.032 | 1.846 | 2.045 | 1.804 | 1.837 | 1.923 | 1.903 | 2.118 | 2.115 | 2.003 |
| W | 0.365 | 0.388 | 0.762 | 0.362 | 0.471 | 0.534 | [illegible] | 0.505 | 0.499 | 0.513 | 0.058 | 0.591 | 0.324 | 0.593 |
| Pb | 0.035 | 0.000 | 0.047 | 0.000 | 0.008 | 0.004 | [illegible] | 0.000 | 0.010 | 0.039 | 0.000 | 0.000 | 0.029 | 0.020 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.017 | 0.039 | 0.036 | 0.000 | 0.004 | 0.000 | 0.017 | 0.000 | 0.009 | 0.051 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.138 | 0.000 | 0.082 | 0.268 | 0.162 | 0.222 | 0.000 | 0.202 | 0.000 | 0.000 | 0.353 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.036 | 0.029 | 0.000 | 0.000 | 0.034 | 0.048 | 0.000 | 0.020 | 0.000 | 0.025 | 0.000 | 0.014 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.073 | 16.000 | 16.029 | 16.000 | 16.055 | 16.000 | 16.000 | 16.015 |

Comments: MD - MF same grain assoc. with cassiterite; incl. in cass.; MP - MR same grain assoc. with ferrotapiolite; MW - MY same grain assoc. cassiterite; incl. in cass.; NE - NJ same grain mantled by cassiterite

oxide-rich sample; ferrowodginite occurs with cassiterite & alluaudite

ferrowodginite (variable W) apart from those analyses otherwise labelled wodginite

**Pegmatite 5**

94-80P

| Raw data | NH | NI | NJ | NO | NP | NQ | NR | NS | BC | CA | CB | CC | CD | CE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 7.79 | 7.77 | 7.67 | 7.70 | 7.76 | 8.32 | 8.29 | 7.88 | 6.21 | 9.70 | 9.16 | 7.34 | 10.27 | 6.96 |
| MnO | 5.56 | 5.85 | 5.71 | 5.74 | 5.72 | 5.25 | 5.38 | 5.69 | 6.55 | 4.49 | 4.57 | 6.69 | 4.69 | 7.06 |
| TiO2 | 1.01 | 0.72 | 0.83 | 1.37 | 0.96 | 1.07 | 1.08 | 0.94 | 1.29 | 1.50 | 1.36 | 1.46 | 1.29 | 1.36 |
| Nb2O5 | 4.58 | 5.28 | 5.62 | 6.92 | 6.16 | 6.17 | 6.75 | 5.84 | 10.52 | 11.32 | 11.39 | 11.75 | 11.51 | 11.61 |
| Ta2O5 | 66.03 | 61.69 | 61.89 | 62.59 | 64.11 | 62.48 | 62.47 | 64.43 | 57.11 | 55.81 | 53.37 | 54.20 | 50.36 | 52.43 |
| SnO2 | 11.99 | 13.22 | 13.00 | 13.21 | 13.69 | 12.67 | 12.74 | 12.05 | 11.39 | 11.88 | 12.06 | 11.56 | 11.31 | 12.04 |
| WO3 | 2.85 | 4.89 | 4.42 | 2.74 | 2.15 | 3.02 | 3.19 | 2.41 | 4.20 | 4.70 | 6.30 | 5.92 | 9.29 | 7.53 |
| PbO | 0.39 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.05 | 0.00 | 0.03 | 0.03 | 0.13 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.22 | 0.08 | 0.92 | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 | 0.63 | 0.11 | 0.20 | 0.02 | 0.00 | 0.09 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.06 | 0.00 | 0.20 | 0.00 | 0.32 | 0.11 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 |
| Total | 100.48 | 99.65 | 100.26 | 100.29 | 100.87 | 100.00 | 100.30 | 99.23 | 98.40 | 99.57 | 98.58 | 99.04 | 98.88 | 99.17 |

| Recalculated | | | | | | | 94-80P | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| oxides | NH | NI | NJ | NO | NP | NQ | NR | NS | BC | CA | CB | CC | CD | CE |
| Li2O | 0.05 | 0.07 | 0.00 | 0.07 | 0.03 | 0.00 | 0.05 | 0.06 | 0.17 | 0.09 | 0.16 | 0.16 | 0.13 | 0.18 |
| FeO | 5.35 | 5.05 | 5.67 | 5.42 | 5.54 | 6.19 | 5.67 | 5.27 | 4.12 | 6.86 | 6.35 | 4.31 | 6.45 | 3.86 |
| MnO | 5.56 | 5.85 | 5.71 | 5.74 | 5.72 | 5.25 | 5.38 | 5.69 | 6.55 | 4.49 | 4.57 | 6.69 | 4.69 | 7.06 |
| Fe2O3 | 2.67 | 2.98 | 2.15 | 2.51 | 2.43 | 2.31 | 2.87 | 2.86 | 2.25 | 3.10 | 3.04 | 3.30 | 4.16 | 3.38 |
| TiO2 | 1.01 | 0.72 | 0.83 | 1.37 | 0.96 | 1.07 | 1.08 | 0.94 | 1.29 | 1.50 | 1.36 | 1.46 | 1.29 | 1.36 |
| Nb2O5 | 4.58 | 5.28 | 5.62 | 6.92 | 6.16 | 6.17 | 6.75 | 5.84 | 10.52 | 11.32 | 11.39 | 11.75 | 11.51 | 11.61 |
| Ta2O5 | 66.03 | 61.69 | 61.89 | 62.59 | 64.11 | 62.48 | 62.47 | 64.43 | 57.11 | 55.81 | 53.37 | 54.20 | 50.36 | 52.43 |
| SnO2 | 11.99 | 13.22 | 13.00 | 13.21 | 13.69 | 12.67 | 12.74 | 12.05 | 11.39 | 11.88 | 12.06 | 11.56 | 11.31 | 12.04 |
| WO3 | 2.85 | 4.89 | 4.42 | 2.74 | 2.15 | 3.02 | 3.19 | 2.41 | 4.20 | 4.70 | 6.30 | 5.92 | 9.29 | 7.53 |
| PbO | 0.39 | 0.16 | 0.00 | 0.00 | 0.00 | 0.00 | 0.42 | 0.00 | 0.05 | 0.00 | 0.03 | 0.03 | 0.13 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.22 | 0.08 | 0.92 | 0.00 | 0.00 | 0.58 | 0.00 | 0.00 | 0.63 | 0.11 | 0.20 | 0.02 | 0.00 | 0.09 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.06 | 0.00 | 0.20 | 0.00 | 0.32 | 0.11 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.05 | 0.00 | 0.02 |
| Total | 100.76 | 99.98 | 100.40 | 100.58 | 101.12 | 100.18 | 100.61 | 99.54 | 98.30 | 99.86 | 98.83 | 99.45 | 99.32 | 99.59 |

**Structural formulae based on 32 oxygens**

| | NH | NI | NJ | NO | NP | NQ | NR | NS | BC | CA | CB | CC | CD | CE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.086 | 0.120 | 0.000 | 0.114 | 0.055 | 0.000 | 0.086 | 0.103 | 0.278 | 0.146 | 0.257 | 0.255 | 0.216 | 0.294 |
| Fe2+ | 1.890 | 1.782 | 1.994 | 1.879 | 1.933 | 2.172 | 1.975 | 1.865 | 1.433 | 2.322 | 2.171 | 1.452 | 2.178 | 1.304 |
| Mn | 1.980 | 2.081 | 2.013 | 2.007 | 2.013 | 1.855 | 1.892 | 2.032 | 2.283 | 1.532 | 1.568 | 2.280 | 1.593 | 2.398 |
| Fe3+ | 0.850 | 0.947 | 0.679 | 0.782 | 0.764 | 0.730 | 0.900 | 0.912 | 0.704 | 0.944 | 0.935 | 1.008 | 1.265 | 1.028 |
| Ti | 0.321 | 0.227 | 0.261 | 0.427 | 0.301 | 0.335 | 0.335 | 0.297 | 0.400 | 0.454 | 0.416 | 0.441 | 0.388 | 0.411 |
| Nb | 0.870 | 1.002 | 1.059 | 1.293 | 1.157 | 1.163 | 1.266 | 1.113 | 1.957 | 2.060 | 2.086 | 2.136 | 2.085 | 2.105 |
| Ta | 7.551 | 7.047 | 7.010 | 7.029 | 7.244 | 7.085 | 7.048 | 7.389 | 6.392 | 6.108 | 5.882 | 5.930 | 5.489 | 5.715 |
| Sn | 2.010 | 2.215 | 2.159 | 2.176 | 2.268 | 2.106 | 2.107 | 2.025 | 1.870 | 1.906 | 1.949 | 1.854 | 1.807 | 1.924 |
| W | 0.310 | 0.532 | 0.477 | 0.294 | 0.232 | 0.326 | 0.343 | 0.264 | 0.448 | 0.491 | 0.661 | 0.617 | 0.965 | 0.782 |
| Pb | 0.044 | 0.018 | 0.000 | 0.000 | 0.000 | 0.000 | 0.046 | 0.000 | 0.006 | 0.000 | 0.003 | 0.003 | 0.013 | 0.004 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.030 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.082 | 0.030 | 0.334 | 0.000 | 0.000 | 0.212 | 0.000 | 0.000 | 0.225 | 0.039 | 0.071 | 0.008 | 0.000 | 0.032 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.006 | 0.000 | 0.021 | 0.000 | 0.034 | 0.012 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.005 | 0.000 | 0.002 |
| Total | 16.000 | 16.000 | 16.007 | 16.000 | 16.000 | 16.027 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | | | | NO & NP<br>incls. in same cass. | | | NQ - NS same grain | | | | | CA - CI<br>same grain<br>assoc. with cassiterite | | |

ferrowodginite (variable W) and a few wodginite

|  | Pegmatite 5 |  |  |  |  |  | Pegmatite 6 |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-80P |  |  |  |  |  | 94-90B |  |  |  |  |  |  |
| Raw data | CH | CI | DA | DB | DC | DD | HA | HB | HC | DG1 | DG2 | DG3 | DG4 |
| FeO | 7.44 | 9.07 | 9.29 | 10.11 | 8.70 | 7.43 | 10.45 | 10.12 | 10.83 | 12.10 | 12.16 | 12.00 | 12.07 |
| MnO | 6.18 | 5.15 | 5.69 | 5.02 | 5.66 | 6.04 | 3.71 | 4.03 | 3.71 | 3.50 | 3.53 | 3.57 | 3.64 |
| TiO2 | 1.71 | 1.41 | 1.40 | 1.06 | 1.08 | 1.56 | 2.65 | 2.69 | 1.25 | 1.91 | 1.94 | 1.99 | 1.95 |
| Nb2O5 | 11.40 | 8.25 | 9.21 | 8.86 | 9.11 | 8.20 | 13.53 | 13.15 | 13.31 | 16.53 | 16.59 | 16.50 | 16.28 |
| Ta2O5 | 57.65 | 53.72 | 50.72 | 50.39 | 54.40 | 58.23 | 55.42 | 55.79 | 55.72 | 40.35 | 39.93 | 40.22 | 40.17 |
| SnO2 | 12.37 | 11.13 | 10.06 | 10.76 | 11.82 | 11.51 | 11.74 | 11.23 | 12.18 | 9.75 | 10.12 | 10.07 | 10.01 |
| WO3 | 3.16 | 10.10 | 12.51 | 12.81 | 8.89 | 4.97 | 1.79 | 1.78 | 2.28 | 13.60 | 13.62 | 13.55 | 13.99 |
| PbO | 0.04 | 0.04 | 0.10 | 0.09 | 0.05 | 0.00 | 0.11 | 0.16 | 0.12 | 0.05 | 0.15 | 0.13 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.14 | 0.07 | 0.09 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.12 | 0.12 | 0.32 | 0.12 | 0.23 | 0.20 |
| Sc2O3 | 0.15 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 | 0.16 | 0.14 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |  |  |  |  |  |  |  |
| Total | 100.13 | 98.88 | 99.02 | 99.17 | 99.75 | 98.08 | 99.62 | 99.21 | 99.63 | 98.20 | 98.36 | 98.33 | 98.50 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Recalculated |  |  | 94-80P |  |  |  |  |  | 94-90B |  |  |  |  |
| oxides | CH | CI | DA | DB | DC | DD | HA | HB | HC | DG1 | DG2 | DG3 | DG4 |
| Li2O | 0.10 | 0.21 | 0.22 | 0.19 | 0.18 | 0.13 | 0.00 | 0.00 | 0.00 | 0.24 | 0.22 | 0.23 | 0.23 |
| FeO | 5.12 | 5.43 | 4.97 | 5.74 | 5.16 | 4.72 | 8.26 | 7.86 | 8.09 | 7.67 | 7.76 | 7.64 | 7.59 |
| MnO | 6.18 | 5.15 | 5.69 | 5.02 | 5.66 | 6.04 | 3.71 | 4.03 | 3.71 | 3.50 | 3.53 | 3.57 | 3.64 |
| Fe2O3 | 2.53 | 3.95 | 4.69 | 4.74 | 3.85 | 2.96 | 2.39 | 2.48 | 3.00 | 4.92 | 4.89 | 4.85 | 4.97 |
| TiO2 | 1.71 | 1.41 | 1.40 | 1.06 | 1.08 | 1.56 | 2.65 | 2.69 | 1.25 | 1.91 | 1.94 | 1.99 | 1.95 |
| Nb2O5 | 11.40 | 8.25 | 9.21 | 8.86 | 9.11 | 8.20 | 13.53 | 13.15 | 13.31 | 16.53 | 16.59 | 16.50 | 16.28 |
| Ta2O5 | 57.65 | 53.72 | 50.72 | 50.39 | 54.40 | 58.23 | 55.42 | 55.79 | 55.72 | 40.35 | 39.93 | 40.22 | 40.17 |
| SnO2 | 12.37 | 11.13 | 10.06 | 10.76 | 11.82 | 11.51 | 11.74 | 11.23 | 12.18 | 9.75 | 10.12 | 10.07 | 10.01 |
| WO3 | 3.16 | 10.10 | 12.51 | 12.81 | 8.89 | 4.97 | 1.79 | 1.78 | 2.28 | 13.60 | 13.62 | 13.55 | 13.99 |
| PbO | 0.04 | 0.04 | 0.10 | 0.09 | 0.05 | 0.00 | 0.11 | 0.16 | 0.12 | 0.05 | 0.15 | 0.13 | 0.12 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.14 | 0.07 | 0.09 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.12 | 0.12 | 0.32 | 0.12 | 0.23 | 0.20 |
| Sc2O3 | 0.15 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 | 0.16 | 0.14 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |  |  |  |  |  |  |  |
| Total | 100.43 | 99.37 | 99.57 | 99.71 | 100.20 | 98.36 | 99.83 | 99.43 | 99.90 | 98.93 | 99.06 | 99.05 | 99.22 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.168 | 0.352 | 0.362 | 0.319 | 0.295 | 0.223 | 0.000 | 0.000 | 0.006 | 0.375 | 0.334 | 0.360 | 0.357 |
| Fe2+ | 1.727 | 1.867 | 1.688 | 1.957 | 1.760 | 1.651 | 2.747 | 2.627 | 2.721 | 2.476 | 2.499 | 2.462 | 2.445 |
| Mn | 2.100 | 1.776 | 1.939 | 1.715 | 1.939 | 2.126 | 1.245 | 1.361 | 1.259 | 1.144 | 1.151 | 1.164 | 1.185 |
| Fe3+ | 0.768 | 1.222 | 1.436 | 1.454 | 1.182 | 0.932 | 0.715 | 0.747 | 0.908 | 1.430 | 1.418 | 1.405 | 1.440 |
| Ti | 0.516 | 0.431 | 0.422 | 0.321 | 0.327 | 0.488 | 0.790 | 0.806 | 0.377 | 0.556 | 0.562 | 0.576 | 0.564 |
| Nb | 2.066 | 1.519 | 1.676 | 1.615 | 1.666 | 1.540 | 2.424 | 2.370 | 2.411 | 2.884 | 2.890 | 2.875 | 2.833 |
| Ta | 6.287 | 5.953 | 5.548 | 5.527 | 5.983 | 6.583 | 5.972 | 6.048 | 6.072 | 4.235 | 4.184 | 4.216 | 4.206 |
| Sn | 1.979 | 1.808 | 1.613 | 1.730 | 1.905 | 1.907 | 1.855 | 1.785 | 1.946 | 1.501 | 1.554 | 1.548 | 1.537 |
| W | 0.329 | 1.067 | 1.304 | 1.339 | 0.931 | 0.535 | 0.184 | 0.184 | 0.237 | 1.360 | 1.360 | 1.354 | 1.396 |
| Pb | 0.004 | 0.005 | 0.011 | 0.010 | 0.005 | 0.000 | 0.012 | 0.017 | 0.013 | 0.006 | 0.016 | 0.014 | 0.013 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.012 | 0.006 | 0.008 |
| U | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.005 | 0.011 | 0.011 | 0.028 | 0.010 | 0.020 | 0.017 |
| Sc | 0.054 | 0.000 | 0.001 | 0.014 | 0.006 | 0.014 | 0.055 | 0.049 | 0.038 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 |
| Bi | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |  |  |  |  |  |  |  |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.004 | 16.005 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | altered part | altered part | DA - DD same grain rimmed by cassiterite |  |  |  | HA - HC same grain note low W content |  |  | DG - QL same grain intergrown, but probably earlier crystallizing than cassiterite complex W distribution |  |  |  |
|  |  |  | wodginite & ferrowodginite |  |  |  | ferrowodginite |  |  | tungsteniferous ferrowodginite |  |  |  |

**Pegmatite 6**

94-90B

| Raw data | DG4 | DG5 | DG6 | DG7 | DG8 | DG9 | DG10 | DG11 | DG12 | DG13 | DG14 | DG15 | DG16 | DG17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 12.07 | 12.14 | 11.99 | 12.06 | 11.78 | 11.67 | 11.59 | 11.70 | 11.96 | 12.07 | 11.79 | 11.71 | 11.56 | 11.77 |
| MnO | 3.64 | 3.55 | 3.54 | 3.52 | 3.47 | 3.38 | 3.36 | 3.38 | 3.47 | 3.46 | 3.57 | 3.51 | 3.49 | 3.53 |
| TiO2 | 1.95 | 1.96 | 1.92 | 1.88 | 1.91 | 1.93 | 1.88 | 1.93 | 1.91 | 1.95 | 2.07 | 1.99 | 1.93 | 1.91 |
| Nb2O5 | 16.28 | 16.49 | 16.66 | 16.24 | 16.89 | 16.72 | 16.53 | 16.74 | 16.77 | 17.11 | 16.84 | 16.95 | 16.97 | 16.86 |
| Ta2O5 | 40.17 | 40.23 | 40.27 | 40.15 | 40.11 | 40.25 | 40.04 | 40.45 | 40.62 | 40.32 | 40.67 | 40.18 | 40.90 | 40.36 |
| SnO2 | 10.01 | 9.99 | 10.04 | 9.94 | 10.36 | 10.12 | 9.64 | 10.08 | 10.28 | 10.13 | 10.24 | 10.20 | 10.24 | 10.15 |
| WO3 | 13.99 | 13.74 | 13.53 | 13.79 | 13.69 | 13.65 | 14.11 | 13.46 | 13.03 | 13.03 | 13.02 | 13.19 | 12.97 | 13.06 |
| PbO | 0.12 | 0.11 | 0.09 | 0.08 | 0.08 | 0.08 | 0.07 | 0.11 | 0.06 | 0.15 | 0.10 | 0.18 | 0.12 | 0.12 |
| ThO2 | 0.09 | 0.04 | 0.12 | 0.09 | 0.04 | 0.08 | 0.00 | 0.02 | 0.13 | 0.00 | 0.04 | 0.10 | 0.02 | 0.02 |
| UO2 | 0.20 | 0.26 | 0.18 | 0.36 | 0.52 | 0.79 | 1.05 | 0.88 | 0.32 | 0.39 | 0.36 | 0.48 | 0.50 | 0.36 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 98.50 | 98.56 | 98.34 | 98.11 | 98.84 | 98.67 | 98.28 | 98.78 | 98.57 | 98.61 | 98.70 | 98.49 | 98.69 | 98.13 |

94-90B

| Recalculated oxides | DG4 | DG5 | DG6 | DG7 | DG8 | DG9 | DG10 | DG11 | DG12 | DG13 | DG14 | DG15 | DG16 | DG17 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.23 | 0.22 | 0.24 | 0.23 | 0.28 | 0.30 | 0.33 | 0.29 | 0.24 | 0.23 | 0.25 | 0.26 | 0.29 | 0.25 |
| FeO | 7.59 | 7.72 | 7.63 | 7.64 | 7.57 | 7.52 | 7.36 | 7.56 | 7.73 | 7.78 | 7.61 | 7.55 | 7.46 | 7.54 |
| MnO | 3.64 | 3.55 | 3.54 | 3.52 | 3.47 | 3.38 | 3.36 | 3.38 | 3.47 | 3.46 | 3.57 | 3.51 | 3.49 | 3.53 |
| Fe2O3 | 4.97 | 4.92 | 4.85 | 4.92 | 4.68 | 4.61 | 4.71 | 4.60 | 4.70 | 4.77 | 4.64 | 4.62 | 4.55 | 4.69 |
| TiO2 | 1.95 | 1.96 | 1.92 | 1.88 | 1.91 | 1.93 | 1.88 | 1.93 | 1.91 | 1.95 | 2.07 | 1.99 | 1.93 | 1.91 |
| Nb2O5 | 16.28 | 16.49 | 16.66 | 16.24 | 16.89 | 16.72 | 16.53 | 16.74 | 16.77 | 17.11 | 16.84 | 16.95 | 16.97 | 16.86 |
| Ta2O5 | 40.17 | 40.23 | 40.27 | 40.15 | 40.11 | 40.25 | 40.04 | 40.45 | 40.62 | 40.32 | 40.67 | 40.18 | 40.90 | 40.36 |
| SnO2 | 10.01 | 9.99 | 10.04 | 9.94 | 10.36 | 10.12 | 9.64 | 10.08 | 10.28 | 10.13 | 10.24 | 10.20 | 10.24 | 10.15 |
| WO3 | 13.99 | 13.74 | 13.53 | 13.79 | 13.69 | 13.65 | 14.11 | 13.46 | 13.03 | 13.03 | 13.02 | 13.19 | 12.97 | 13.06 |
| PbO | 0.12 | 0.11 | 0.09 | 0.08 | 0.08 | 0.08 | 0.07 | 0.11 | 0.06 | 0.15 | 0.10 | 0.18 | 0.12 | 0.12 |
| ThO2 | 0.09 | 0.04 | 0.12 | 0.09 | 0.04 | 0.08 | 0.00 | 0.02 | 0.13 | 0.00 | 0.04 | 0.10 | 0.02 | 0.02 |
| UO2 | 0.20 | 0.26 | 0.18 | 0.36 | 0.52 | 0.79 | 1.05 | 0.88 | 0.32 | 0.39 | 0.36 | 0.48 | 0.50 | 0.36 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.05 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 99.22 | 99.28 | 99.07 | 98.84 | 99.59 | 99.43 | 99.07 | 99.53 | 99.28 | 99.32 | 99.41 | 99.21 | 99.44 | 98.85 |

**Structural formulae based on 32 oxygens**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.357 | 0.349 | 0.379 | 0.366 | 0.440 | 0.468 | 0.515 | 0.453 | 0.374 | 0.361 | 0.384 | 0.409 | 0.454 | 0.397 |
| Fe2+ | 2.445 | 2.482 | 2.458 | 2.471 | 2.426 | 2.421 | 2.378 | 2.433 | 2.488 | 2.498 | 2.444 | 2.430 | 2.399 | 2.436 |
| Mn | 1.185 | 1.157 | 1.154 | 1.155 | 1.126 | 1.103 | 1.099 | 1.103 | 1.132 | 1.126 | 1.161 | 1.142 | 1.135 | 1.154 |
| Fe3+ | 1.440 | 1.423 | 1.405 | 1.432 | 1.351 | 1.335 | 1.368 | 1.331 | 1.361 | 1.378 | 1.340 | 1.339 | 1.315 | 1.363 |
| Ti | 0.564 | 0.566 | 0.555 | 0.548 | 0.550 | 0.558 | 0.547 | 0.557 | 0.553 | 0.562 | 0.596 | 0.577 | 0.557 | 0.554 |
| Nb | 2.833 | 2.867 | 2.901 | 2.841 | 2.927 | 2.908 | 2.888 | 2.911 | 2.918 | 2.969 | 2.921 | 2.949 | 2.948 | 2.943 |
| Ta | 4.206 | 4.208 | 4.218 | 4.225 | 4.182 | 4.212 | 4.208 | 4.231 | 4.251 | 4.210 | 4.245 | 4.204 | 4.274 | 4.238 |
| Sn | 1.537 | 1.532 | 1.542 | 1.533 | 1.584 | 1.552 | 1.485 | 1.546 | 1.578 | 1.551 | 1.568 | 1.566 | 1.569 | 1.562 |
| W | 1.396 | 1.370 | 1.351 | 1.383 | 1.360 | 1.361 | 1.413 | 1.341 | 1.300 | 1.296 | 1.296 | 1.315 | 1.292 | 1.307 |
| Pb | 0.013 | 0.011 | 0.009 | 0.009 | 0.008 | 0.008 | 0.008 | 0.012 | 0.006 | 0.015 | 0.011 | 0.018 | 0.012 | 0.012 |
| Th | 0.008 | 0.004 | 0.010 | 0.008 | 0.003 | 0.007 | 0.000 | 0.002 | 0.011 | 0.000 | 0.004 | 0.009 | 0.002 | 0.002 |
| U | 0.017 | 0.022 | 0.015 | 0.031 | 0.044 | 0.067 | 0.090 | 0.075 | 0.028 | 0.033 | 0.031 | 0.041 | 0.043 | 0.031 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.008 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | | | | | | | | | |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments:

DG - QL same grain

intergrown, but probably earlier crystallizing than cassiterite

complex W distribution

tungsteniferous ferrowodginite

**Pegmatite 6**

94-90B

| Raw data | DG18 | DG20 | DG21 | DG24 | DG25 | DG26 | DG27 | DG28 | DG30 | DG32 | DG34 | DG35 | DG36 | DG39 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 11.77 | 10.73 | 12.07 | 11.81 | 11.86 | 11.55 | 11.87 | 11.64 | 10.96 | 10.77 | 11.62 | 11.49 | 11.65 | 12.22 |
| MnO | 3.58 | 3.09 | 3.62 | 3.60 | 3.54 | 3.59 | 3.62 | 3.46 | 3.32 | 3.13 | 3.51 | 3.34 | 3.48 | 3.75 |
| TiO2 | 1.91 | 1.73 | 1.93 | 2.04 | 2.01 | 1.92 | 1.94 | 1.93 | 1.41 | 1.53 | 1.99 | 2.23 | 2.14 | 1.81 |
| Nb2O5 | 17.02 | 15.97 | 17.02 | 17.65 | 17.38 | 17.63 | 17.15 | 17.74 | 14.53 | 14.80 | 17.43 | 17.77 | 16.76 | 15.84 |
| Ta2O5 | 40.20 | 38.90 | 39.75 | 39.57 | 39.38 | 39.73 | 40.01 | 39.56 | 31.76 | 32.62 | 40.42 | 42.33 | 42.18 | 37.32 |
| SnO2 | 10.14 | 9.19 | 9.67 | 10.32 | 10.06 | 10.27 | 10.16 | 9.87 | 8.48 | 8.34 | 9.08 | 10.58 | 10.46 | 9.77 |
| WO3 | 13.77 | 15.51 | 13.66 | 13.44 | 13.53 | 13.46 | 13.39 | 13.40 | 24.42 | 23.20 | 13.77 | 10.50 | 11.39 | 17.53 |
| PbO | 0.15 | 0.11 | 0.14 | 0.09 | 0.11 | 0.18 | 0.09 | 0.11 | 0.09 | 0.07 | 0.13 | 0.07 | 0.13 | 0.15 |
| ThO2 | 0.01 | 0.02 | 0.00 | 0.11 | 0.20 | 0.04 | 0.16 | 0.14 | 0.13 | 0.16 | 0.00 | 0.07 | 0.19 | 0.01 |
| UO2 | 0.41 | 1.47 | 0.38 | 0.38 | 0.34 | 0.41 | 0.39 | 0.56 | 2.37 | 2.37 | 0.77 | 0.42 | 0.35 | 0.18 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 98.99 | 96.72 | 98.25 | 99.00 | 98.41 | 98.79 | 98.78 | 98.41 | 97.49 | 97.00 | 98.71 | 98.80 | 98.72 | 98.56 |

| Recalculated<br>oxides |  |  |  |  |  |  |  | 94-90B |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DG18 | DG20 | DG21 | DG24 | DG25 | DG26 | DG27 | DG28 | DG30 | DG32 | DG34 | DG35 | DG36 | DG39 |
| Li2O | 0.28 | 0.48 | 0.23 | 0.27 | 0.26 | 0.30 | 0.25 | 0.31 | 0.66 | 0.67 | 0.33 | 0.25 | 0.22 | 0.29 |
| FeO | 7.47 | 6.65 | 7.59 | 7.59 | 7.59 | 7.37 | 7.58 | 7.4[illegible] | 5.72 | 5.79 | 7.28 | 7.86 | 7.78 | 7.21 |
| MnO | 3.58 | 3.09 | 3.62 | 3.60 | 3.54 | 3.59 | 3.62 | 3.46 | 3.32 | 3.13 | 3.51 | 3.34 | 3.48 | 3.75 |
| Fe2O3 | 4.78 | 4.53 | 4.98 | 4.69 | 4.74 | 4.65 | 4.77 | 4.67 | 5.82 | 5.53 | 4.83 | 4.03 | 4.30 | 5.57 |
| TiO2 | 1.91 | 1.73 | 1.93 | 2.04 | 2.01 | 1.92 | 1.94 | 1.93 | 1.41 | 1.53 | 1.99 | 2.23 | 2.14 | 1.81 |
| Nb2O5 | 17.02 | 15.97 | 17.02 | 17.65 | 17.38 | 17.63 | 17.15 | 17.74 | 14.53 | 14.80 | 17.43 | 17.77 | 16.76 | 15.84 |
| Ta2O5 | 40.20 | 38.90 | 39.75 | 39.57 | 39.38 | 39.73 | 40.01 | 39.56 | 31.76 | 32.62 | 40.42 | 42.33 | 42.18 | 37.32 |
| SnO2 | 10.14 | 9.19 | 9.67 | 10.32 | 10.06 | 10.27 | 10.16 | 9.87 | 8.48 | 8.34 | 9.08 | 10.58 | 10.46 | 9.77 |
| WO3 | 13.77 | 15.51 | 13.66 | 13.44 | 13.53 | 13.46 | 13.39 | 13.40 | 24.42 | 23.20 | 13.77 | 10.50 | 11.39 | 17.53 |
| PbO | 0.15 | 0.11 | 0.14 | 0.09 | 0.11 | 0.18 | 0.09 | 0.11 | 0.09 | 0.07 | 0.13 | 0.07 | 0.13 | 0.15 |
| ThO2 | 0.01 | 0.02 | 0.00 | 0.11 | 0.20 | 0.04 | 0.16 | 0.14 | 0.13 | 0.16 | 0.00 | 0.07 | 0.19 | 0.01 |
| UO2 | 0.41 | 1.47 | 0.38 | 0.38 | 0.34 | 0.41 | 0.39 | 0.56 | 2.37 | 2.37 | 0.77 | 0.42 | 0.35 | 0.18 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 99.75 | 97.65 | 98.99 | 99.74 | 99.14 | 99.55 | 99.50 | 99.19 | 98.73 | 98.22 | 99.53 | 99.45 | 99.37 | 99.41 |

**Structural formulae based on 32 oxygens**

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.435 | 0.772 | 0.367 | 0.412 | 0.406 | 0.464 | 0.387 | 0.478 | 1.047 | 1.072 | 0.521 | 0.386 | 0.342 | 0.460 |
| Fe2+ | 2.389 | 2.186 | 2.441 | 2.418 | 2.434 | 2.354 | 2.428 | 2.386 | 1.855 | 1.889 | 2.329 | 2.521 | 2.508 | 2.309 |
| Mn | 1.160 | 1.030 | 1.178 | 1.161 | 1.149 | 1.163 | 1.175 | 1.125 | 1.090 | 1.032 | 1.136 | 1.085 | 1.136 | 1.216 |
| Fe3+ | 1.376 | 1.340 | 1.442 | 1.343 | 1.368 | 1.338 | 1.375 | 1.346 | 1.700 | 1.623 | 1.391 | 1.162 | 1.246 | 1.605 |
| Ti | 0.549 | 0.512 | 0.560 | 0.584 | 0.580 | 0.551 | 0.558 | 0.556 | 0.410 | 0.448 | 0.572 | 0.642 | 0.619 | 0.521 |
| Nb | 2.942 | 2.838 | 2.960 | 3.038 | 3.013 | 3.045 | 2.970 | 3.075 | 2.549 | 2.609 | 3.015 | 3.079 | 2.921 | 2.741 |
| Ta | 4.181 | 4.159 | 4.159 | 4.099 | 4.108 | 4.129 | 4.169 | 4.124 | 3.351 | 3.458 | 4.206 | 4.414 | 4.422 | 3.886 |
| Sn | 1.546 | 1.441 | 1.484 | 1.567 | 1.539 | 1.565 | 1.552 | 1.509 | 1.312 | 1.296 | 1.385 | 1.618 | 1.607 | 1.491 |
| W | 1.365 | 1.580 | 1.362 | 1.327 | 1.345 | 1.333 | 1.329 | 1.332 | 2.456 | 2.343 | 1.366 | 1.044 | 1.138 | 1.739 |
| Pb | 0.016 | 0.012 | 0.015 | 0.009 | 0.011 | 0.019 | 0.009 | 0.011 | 0.009 | 0.007 | 0.013 | 0.007 | 0.013 | 0.015 |
| Th | 0.001 | 0.002 | 0.000 | 0.010 | 0.018 | 0.004 | 0.014 | 0.012 | 0.011 | 0.014 | 0.000 | 0.006 | 0.017 | 0.001 |
| U | 0.035 | 0.128 | 0.033 | 0.032 | 0.029 | 0.035 | 0.033 | 0.048 | 0.205 | 0.205 | 0.066 | 0.036 | 0.030 | 0.015 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | | | | | | | | | |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments:

DG - QL same grain

intergrown, but probably earlier crystallizing than cassiterite

complex W distribution

tungsteniferous ferrowodginite

| | | | | | | | Pegmatite 6 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | 94-90B | | | | | | | |
| **Raw data** | DG40 | DH48 | DH49 | DH50 | DH51 | DH52 | DH53 | DH54 | DH55 | DH56 | DH57 | DH58 | DH59 | DH60 |
| FeO | 12.33 | 11.71 | 11.46 | 11.69 | 12.46 | 11.73 | 12.32 | 11.82 | 12.55 | 12.76 | 12.34 | 13.04 | 13.17 | 13.11 |
| MnO | 3.72 | 3.64 | 3.40 | 3.54 | 3.80 | 3.49 | 3.74 | 3.49 | 3.95 | 4.14 | 3.61 | 3.96 | 4.01 | 3.93 |
| TiO2 | 1.70 | 1.89 | 2.10 | 2.03 | 1.46 | 1.76 | 1.40 | 1.64 | 1.26 | 1.25 | 1.16 | 1.14 | 1.09 | 1.17 |
| Nb2O5 | 15.87 | 16.27 | 17.50 | 16.94 | 16.14 | 15.97 | 14.70 | 15.86 | 15.01 | 16.43 | 14.16 | 13.61 | 13.94 | 14.19 |
| Ta2O5 | 36.64 | 40.53 | 43.55 | 42.40 | 35.08 | 41.82 | 36.93 | 41.61 | 34.95 | 34.91 | 32.43 | 32.56 | 32.21 | 32.66 |
| SnO2 | 9.72 | 10.38 | 10.86 | 10.61 | 9.64 | 10.37 | 9.76 | 10.34 | 7.52 | 6.31 | 8.34 | 8.82 | 8.53 | 8.65 |
| WO3 | 17.61 | 13.08 | 10.10 | 11.66 | 19.91 | 13.05 | 19.11 | 12.89 | 22.54 | 22.63 | 25.03 | 25.10 | 25.37 | 24.81 |
| PbO | 0.14 | 0.05 | 0.07 | 0.12 | 0.03 | 0.13 | 0.09 | 0.04 | 0.11 | 0.09 | 0.07 | 0.09 | 0.11 | 0.10 |
| ThO2 | 0.15 | 0.14 | 0.10 | 0.03 | 0.12 | 0.06 | 0.19 | 0.05 | 0.01 | 0.00 | 0.09 | 0.03 | 0.05 | 0.05 |
| UO2 | 0.32 | 0.30 | 0.28 | 0.32 | 0.51 | 0.30 | 0.22 | 0.25 | 0.26 | 0.39 | 1.32 | 0.12 | 0.38 | 0.53 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 98.20 | 97.99 | 99.40 | 99.39 | 99.16 | 98.68 | 98.43 | 98.06 | 98.15 | 98.90 | 98.55 | 98.49 | 98.88 | 99.19 |
| | | | | | | | | | | | | | | |
| **Recalculated** | | | | | | | 94-90B | | | | | | | |
| oxides | DG40 | DH48 | DH49 | DH50 | DH51 | DH52 | DH53 | DH54 | DH55 | DH56 | DH57 | DH58 | DH59 | DH60 |
| Li2O | 0.28 | 0.23 | 0.24 | 0.23 | 0.35 | 0.26 | 0.32 | 0.24 | 0.43 | 0.45 | 0.52 | 0.38 | 0.38 | 0.39 |
| FeO | 7.27 | 7.51 | 7.86 | 7.76 | 7.04 | 7.52 | 7.02 | 7.58 | 6.35 | 6.23 | 6.27 | 6.57 | 6.58 | 6.67 |
| MnO | 3.72 | 3.64 | 3.40 | 3.54 | 3.80 | 3.49 | 3.74 | 3.49 | 3.95 | 4.14 | 3.61 | 3.96 | 4.01 | 3.93 |
| Fe2O3 | 5.62 | 4.66 | 4.00 | 4.36 | 6.02 | 4.67 | 5.89 | 4.71 | 6.89 | 7.25 | 6.74 | 7.19 | 7.33 | 7.15 |
| TiO2 | 1.70 | 1.89 | 2.10 | 2.03 | 1.46 | 1.76 | 1.40 | 1.64 | 1.26 | 1.25 | 1.16 | 1.14 | 1.09 | 1.17 |
| Nb2O5 | 15.87 | 16.27 | 17.50 | 16.94 | 16.14 | 15.97 | 14.70 | 15.86 | 15.01 | 16.43 | 14.16 | 13.61 | 13.94 | 14.19 |
| Ta2O5 | 36.64 | 40.53 | 43.55 | 42.40 | 35.08 | 41.82 | 36.93 | 41.61 | 34.95 | 34.91 | 32.43 | 32.56 | 32.21 | 32.66 |
| SnO2 | 9.72 | 10.38 | 10.86 | 10.61 | 9.64 | 10.37 | 9.76 | 10.34 | 7.52 | 6.31 | 8.34 | 8.82 | 8.53 | 8.65 |
| WO3 | 17.61 | 13.08 | 10.10 | 11.66 | 19.91 | 13.05 | 19.11 | 12.89 | 22.54 | 22.63 | 25.03 | 25.10 | 25.37 | 24.81 |
| PbO | 0.14 | 0.05 | 0.07 | 0.12 | 0.03 | 0.13 | 0.09 | 0.04 | 0.11 | 0.09 | 0.07 | 0.09 | 0.11 | 0.10 |
| ThO2 | 0.15 | 0.14 | 0.10 | 0.03 | 0.12 | 0.06 | 0.19 | 0.05 | 0.01 | 0.00 | 0.09 | 0.03 | 0.05 | 0.05 |
| UO2 | 0.32 | 0.30 | 0.28 | 0.32 | 0.51 | 0.30 | 0.22 | 0.25 | 0.26 | 0.39 | 1.32 | 0.12 | 0.38 | 0.53 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.01 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 |
| Bi2O3 | | | | | | | | | | | | | | |
| Total | 99.04 | 98.69 | 100.05 | 100.06 | 100.11 | 99.41 | 99.34 | 98.77 | 99.27 | 100.08 | 99.74 | 99.59 | 99.99 | 100.30 |
| | | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | | |
| Li | 0.437 | 0.362 | 0.377 | 0.358 | 0.540 | 0.411 | 0.505 | 0.376 | 0.673 | 0.700 | 0.809 | 0.602 | 0.596 | 0.604 |
| Fe2+ | 2.339 | 2.437 | 2.514 | 2.484 | 2.235 | 2.434 | 2.265 | 2.469 | 2.034 | 1.968 | 2.012 | 2.103 | 2.098 | 2.120 |
| Mn | 1.210 | 1.196 | 1.102 | 1.146 | 1.221 | 1.142 | 1.221 | 1.152 | 1.281 | 1.323 | 1.173 | 1.285 | 1.295 | 1.265 |
| Fe3+ | 1.627 | 1.361 | 1.150 | 1.257 | 1.720 | 1.360 | 1.710 | 1.379 | 1.988 | 2.060 | 1.945 | 2.073 | 2.102 | 2.046 |
| Ti | 0.492 | 0.551 | 0.604 | 0.584 | 0.418 | 0.511 | 0.405 | 0.480 | 0.362 | 0.353 | 0.334 | 0.329 | 0.312 | 0.334 |
| Nb | 2.759 | 2.853 | 3.027 | 2.930 | 2.770 | 2.791 | 2.563 | 2.792 | 2.600 | 2.805 | 2.454 | 2.356 | 2.402 | 2.439 |
| Ta | 3.833 | 4.275 | 4.531 | 4.413 | 3.621 | 4.399 | 3.875 | 4.406 | 3.641 | 3.585 | 3.382 | 3.390 | 3.340 | 3.377 |
| Sn | 1.492 | 1.605 | 1.656 | 1.619 | 1.459 | 1.599 | 1.501 | 1.606 | 1.148 | 0.951 | 1.276 | 1.347 | 1.296 | 1.311 |
| W | 1.756 | 1.315 | 1.001 | 1.156 | 1.958 | 1.308 | 1.911 | 1.301 | 2.238 | 2.214 | 2.488 | 2.491 | 2.506 | 2.444 |
| Pb | 0.014 | 0.005 | 0.007 | 0.013 | 0.003 | 0.013 | 0.009 | 0.004 | 0.011 | 0.009 | 0.007 | 0.009 | 0.011 | 0.011 |
| Th | 0.013 | 0.012 | 0.008 | 0.003 | 0.011 | 0.006 | 0.016 | 0.004 | 0.001 | 0.000 | 0.008 | 0.003 | 0.005 | 0.004 |
| U | 0.028 | 0.026 | 0.023 | 0.027 | 0.043 | 0.026 | 0.019 | 0.022 | 0.022 | 0.033 | 0.113 | 0.010 | 0.032 | 0.045 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.001 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 | 0.011 | 0.000 | 0.000 | 0.001 | 0.000 | 0.004 | 0.000 |
| Bi | | | | | | | | | | | | | | |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

**Comments:**

DG - QL same grain

intergrown, but probably earlier crystallizing than cassiterite

complex W distribution

tungsteniferous ferrowodginite

| | | | | | Pegmatite 6 | | | | | | Peg. 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 94-90B | | | | | | 94-318 |
| **Raw data** | QA | QB | QC | QD | QE | QF | QG | QH | QI | QK | QL | MD |
| FeO | 12.88 | 13.06 | 12.40 | 12.35 | 11.38 | 11.64 | 12.14 | 12.56 | 11.83 | 11.50 | 12.80 | 11.77 |
| MnO | 3.90 | 3.91 | 3.65 | 3.68 | 3.40 | 3.40 | 3.63 | 3.80 | 4.25 | 3.38 | 4.21 | 1.69 |
| TiO2 | 1.62 | 1.59 | 2.02 | 1.61 | 1.62 | 2.12 | 1.94 | 1.44 | 1.28 | 1.43 | 1.22 | 1.27 |
| Nb2O5 | 14.74 | 14.62 | 16.66 | 14.64 | 15.54 | 17.20 | 16.44 | 14.16 | 16.55 | 15.17 | 13.74 | 10.26 |
| Ta2O5 | 35.60 | 34.51 | 39.87 | 35.61 | 36.94 | 40.32 | 40.03 | 30.30 | 31.50 | 32.85 | 32.94 | 55.08 |
| SnO2 | 9.32 | 8.95 | 9.80 | 9.06 | 9.44 | 9.90 | 9.94 | 7.91 | 6.11 | 8.75 | 10.95 | 18.80 |
| WO3 | 21.23 | 22.54 | 14.68 | 21.00 | 18.03 | 13.33 | 14.29 | 26.31 | 25.02 | 23.84 | 22.98 | 1.43 |
| PbO | 0.10 | 0.09 | 0.15 | 0.14 | 0.14 | 0.12 | 0.14 | 0.13 | 0.06 | 0.11 | 0.03 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| UO2 | 0.02 | 0.05 | 0.00 | 0.07 | 0.02 | 0.05 | 0.00 | 0.03 | 0.01 | 0.01 | 0.00 | 0.13 |
| Sc2O3 | 0.23 | 0.14 | 0.32 | 0.44 | 0.95 | 0.42 | 0.29 | 0.60 | 0.51 | 0.93 | 0.20 | 0.08 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 |
| Total | 99.64 | 99.44 | 99.55 | 98.60 | 97.47 | 98.51 | 98.83 | 97.27 | 97.15 | 97.97 | 99.06 | 100.64 |

| **Recalculated** | | | | | | 94-90B | | | | | | 94-318 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **oxides** | QA | QB | QC | QD | QE | QF | QG | QH | QI | QK | QL | MD |
| Li2O | 0.29 | 0.32 | 0.19 | 0.33 | 0.33 | 0.25 | 0.20 | 0.41 | 0.53 | 0.50 | 0.25 | 0.00 |
| FeO | 7.14 | 7.00 | 7.83 | 6.98 | 7.14 | 7.68 | 7.69 | 6.42 | 5.53 | 6.44 | 6.94 | 10.42 |
| MnO | 3.90 | 3.91 | 3.65 | 3.68 | 3.40 | 3.40 | 3.63 | 3.80 | 4.25 | 3.38 | 4.21 | 1.69 |
| Fe2O3 | 6.18 | 6.53 | 4.92 | 5.74 | 4.47 | 4.24 | 4.80 | 6.55 | 6.70 | 5.32 | 6.33 | 1.48 |
| TiO2 | 1.62 | 1.59 | 2.02 | 1.61 | 1.62 | 2.12 | 1.94 | 1.44 | 1.28 | 1.43 | 1.22 | 1.27 |
| Nb2O5 | 14.74 | 14.62 | 16.66 | 14.64 | 15.54 | 17.20 | 16.44 | 14.16 | 16.55 | 15.17 | 13.74 | 10.26 |
| Ta2O5 | 35.60 | 34.51 | 39.87 | 35.61 | 36.94 | 40.32 | 40.03 | 30.30 | 31.50 | 32.85 | 32.94 | 55.08 |
| SnO2 | 9.32 | 8.95 | 9.80 | 9.06 | 9.44 | 9.90 | 9.94 | 7.91 | 6.11 | 8.75 | 10.95 | 18.80 |
| WO3 | 21.23 | 22.54 | 14.68 | 21.00 | 18.03 | 13.33 | 14.29 | 26.31 | 25.02 | 23.84 | 22.98 | 1.43 |
| PbO | 0.10 | 0.09 | 0.15 | 0.14 | 0.14 | 0.12 | 0.14 | 0.13 | 0.06 | 0.11 | 0.03 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| UO2 | 0.02 | 0.05 | 0.00 | 0.07 | 0.02 | 0.05 | 0.00 | 0.03 | 0.01 | 0.01 | 0.00 | 0.13 |
| Sc2O3 | 0.23 | 0.14 | 0.32 | 0.44 | 0.95 | 0.42 | 0.29 | 0.60 | 0.51 | 0.93 | 0.20 | 0.08 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.04 | 0.03 | 0.00 | 0.00 | 0.00 |
| Total | 100.37 | 100.22 | 100.10 | 99.30 | 98.03 | 99.04 | 99.38 | 98.08 | 98.08 | 98.73 | 99.78 | 100.77 |

**Structural formulae based on 32 oxygens**

| | QA | QB | QC | QD | QE | QF | QG | QH | QI | QK | QL | MD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.446 | 0.492 | 0.297 | 0.522 | 0.516 | 0.397 | 0.318 | 0.651 | 0.825 | 0.791 | 0.391 | 0.000 |
| Fe2+ | 2.292 | 2.247 | 2.514 | 2.270 | 2.356 | 2.490 | 2.489 | 2.102 | 1.800 | 2.105 | 2.246 | 3.531 |
| Mn | 1.251 | 1.252 | 1.173 | 1.194 | 1.113 | 1.101 | 1.178 | 1.234 | 1.369 | 1.093 | 1.361 | 0.579 |
| Fe3+ | 1.785 | 1.886 | 1.422 | 1.681 | 1.328 | 1.237 | 1.399 | 1.930 | 1.964 | 1.564 | 1.844 | 0.452 |
| Ti | 0.462 | 0.452 | 0.575 | 0.464 | 0.472 | 0.610 | 0.557 | 0.416 | 0.365 | 0.410 | 0.350 | 0.386 |
| Nb | 2.522 | 2.501 | 2.857 | 2.533 | 2.720 | 2.977 | 2.846 | 2.457 | 2.846 | 2.618 | 2.373 | 1.877 |
| Ta | 3.664 | 3.551 | 4.115 | 3.705 | 3.890 | 4.197 | 4.168 | 3.162 | 3.258 | 3.409 | 3.422 | 6.060 |
| Sn | 1.407 | 1.350 | 1.483 | 1.382 | 1.458 | 1.511 | 1.517 | 1.211 | 0.927 | 1.331 | 1.669 | 3.033 |
| W | 2.083 | 2.210 | 1.444 | 2.083 | 1.809 | 1.322 | 1.418 | 2.617 | 2.466 | 2.358 | 2.276 | 0.150 |
| Pb | 0.010 | 0.009 | 0.016 | 0.015 | 0.015 | 0.012 | 0.015 | 0.013 | 0.006 | 0.011 | 0.003 | 0.012 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| U | 0.002 | 0.004 | 0.000 | 0.006 | 0.002 | 0.004 | 0.000 | 0.002 | 0.001 | 0.001 | 0.000 | 0.012 |
| Sc | 0.075 | 0.046 | 0.104 | 0.146 | 0.322 | 0.141 | 0.096 | 0.201 | 0.170 | 0.309 | 0.068 | 0.028 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.004 | 0.003 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.122 |

| Comments: | | |
|---|---|---|
| | DG - QL same grain | inclusion |
| | intergrown, but probably earlier crystallizing than cassiterite | in |
| | complex W distribution | cassiterite |
| | | |
| | tungsteniferous ferrowodginite | Fe wodginite |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pegmatite 7** | | | **Pegmatite 7** | | | | | | | | | |
| | 94-Peg 7B | | | 94-Peg 7E | | | | | | | | | |
| **Raw data** | QE | QM | QP | BB | BD | BJ | BK | BE | BF | BG | EA1 | EA2 | EA5 |
| FeO | 10.77 | 11.51 | 10.53 | 6.15 | 7.86 | 6.58 | 7.41 | 7.75 | 6.27 | 7.06 | 6.31 | 5.91 | 7.57 |
| MnO | 4.47 | 4.12 | 4.61 | 7.05 | 6.95 | 7.37 | 6.41 | 7.13 | 7.11 | 7.22 | 6.50 | 6.42 | 6.41 |
| TiO2 | 1.28 | 1.24 | 1.46 | 0.48 | 0.55 | 0.69 | 0.74 | 0.50 | 0.47 | 0.48 | 0.54 | 0.42 | 0.43 |
| Nb2O5 | 16.42 | 15.36 | 13.75 | 5.34 | 7.18 | 6.80 | 7.31 | 6.86 | 5.40 | 5.81 | 6.13 | 5.84 | 7.34 |
| Ta2O5 | 47.78 | 49.67 | 54.35 | 62.82 | 56.27 | 62.22 | 61.93 | 55.57 | 62.92 | 59.04 | 62.28 | 61.64 | 53.90 |
| SnO2 | 11.33 | 11.69 | 11.55 | 14.03 | 11.90 | 13.76 | 12.02 | 11.83 | 14.34 | 12.87 | 12.72 | 13.95 | 11.40 |
| WO3 | 5.50 | 5.26 | 3.25 | 3.82 | 7.15 | 2.42 | 2.58 | 8.07 | 2.46 | 5.94 | 3.24 | 3.49 | 10.25 |
| PbO | 0.10 | 0.08 | 0.10 | 0.03 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.15 | 0.00 | 0.00 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.00 | 0.02 | 0.09 | 0.15 | 0.14 | 0.15 | 0.18 | 0.06 | 0.09 | 0.12 | 0.22 | 0.09 |
| Sc2O3 | | | | 0.03 | 0.02 | 0.05 | 0.05 | 0.02 | 0.06 | 0.02 | 0.13 | 0.00 | 0.00 |
| Sb2O3 | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| **Total** | 97.71 | 98.93 | 99.62 | 99.84 | 98.14 | 100.13 | 98.71 | 98.01 | 99.17 | 98.68 | 97.98 | 97.88 | 97.48 |
| | | | | | | | | | | | | | |
| **Recalculated** | 94-Peg 7B | | | 94-Peg 7E | | | | | | | | | |
| oxides | QE | QM | QP | BB | BD | BJ | BK | BE | BF | BG | EA1 | EA2 | EA5 |
| Li2O | 0.04 | 0.00 | 0.00 | 0.10 | 0.02 | 0.00 | 0.03 | 0.03 | 0.01 | 0.02 | 0.13 | 0.18 | 0.23 |
| FeO | 7.26 | 7.92 | 7.35 | 3.72 | 4.22 | 4.04 | 4.67 | 3.97 | 3.98 | 3.84 | 3.96 | 3.77 | 3.76 |
| MnO | 4.47 | 4.12 | 4.61 | 7.05 | 6.95 | 7.37 | 6.41 | 7.13 | 7.11 | 7.22 | 6.50 | 6.42 | 6.41 |
| Fe2O3 | 3.84 | 3.94 | 3.49 | 2.66 | 4.01 | 2.80 | 3.01 | 4.16 | 2.53 | 3.54 | 2.57 | 2.33 | 4.15 |
| TiO2 | 1.28 | 1.24 | 1.46 | 0.48 | 0.55 | 0.69 | 0.74 | 0.50 | 0.47 | 0.48 | 0.54 | 0.42 | 0.43 |
| Nb2O5 | 16.42 | 15.36 | 13.75 | 5.34 | 7.18 | 6.80 | 7.31 | 6.86 | 5.40 | 5.81 | 6.13 | 5.84 | 7.34 |
| Ta2O5 | 47.78 | 49.67 | 54.35 | 62.82 | 56.27 | 62.22 | 61.93 | 55.57 | 62.92 | 59.04 | 62.28 | 61.64 | 53.90 |
| SnO2 | 11.33 | 11.69 | 11.55 | 14.03 | 11.90 | 13.76 | 12.02 | 11.83 | 14.34 | 12.87 | 12.72 | 13.95 | 11.40 |
| WO3 | 5.50 | 5.26 | 3.25 | 3.82 | 7.15 | 2.42 | 2.58 | 8.07 | 2.46 | 5.94 | 3.24 | 3.49 | 10.25 |
| PbO | 0.10 | 0.08 | 0.10 | 0.03 | 0.10 | 0.10 | 0.10 | 0.10 | 0.08 | 0.15 | 0.00 | 0.00 | 0.08 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.00 | 0.02 | 0.09 | 0.15 | 0.14 | 0.15 | 0.18 | 0.06 | 0.09 | 0.12 | 0.22 | 0.09 |
| Sc2O3 | | | | 0.03 | 0.02 | 0.05 | 0.05 | 0.02 | 0.06 | 0.02 | 0.13 | 0.00 | 0.00 |
| Sb2O3 | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| **Total** | 98.09 | 99.29 | 99.94 | 100.17 | 98.53 | 100.39 | 99.01 | 98.42 | 99.41 | 99.03 | 98.32 | 98.25 | 98.04 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.066 | 0.000 | 0.000 | 0.165 | 0.037 | 0.000 | 0.053 | 0.056 | 0.013 | 0.039 | 0.226 | 0.311 | 0.390 |
| Fe2+ | 2.421 | 2.625 | 2.453 | 1.317 | 1.485 | 1.413 | 1.651 | 1.399 | 1.418 | 1.363 | 1.422 | 1.360 | 1.329 |
| Mn | 1.502 | 1.378 | 1.552 | 2.514 | 2.466 | 2.600 | 2.285 | 2.534 | 2.560 | 2.581 | 2.351 | 2.329 | 2.271 |
| Fe3+ | 1.153 | 1.176 | 1.048 | 0.848 | 1.269 | 0.879 | 0.957 | 1.320 | 0.811 | 1.130 | 0.831 | 0.757 | 1.319 |
| Ti | 0.382 | 0.368 | 0.437 | 0.152 | 0.173 | 0.216 | 0.234 | 0.158 | 0.150 | 0.152 | 0.174 | 0.135 | 0.136 |
| Nb | 2.946 | 2.742 | 2.471 | 1.016 | 1.360 | 1.280 | 1.391 | 1.301 | 1.038 | 1.109 | 1.182 | 1.131 | 1.389 |
| Ta | 5.156 | 5.334 | 5.876 | 7.192 | 6.411 | 7.047 | 7.087 | 6.340 | 7.272 | 6.777 | 7.229 | 7.184 | 6.133 |
| Sn | 1.793 | 1.841 | 1.831 | 2.355 | 1.988 | 2.285 | 2.017 | 1.979 | 2.430 | 2.166 | 2.165 | 2.384 | 1.902 |
| W | 0.566 | 0.538 | 0.335 | 0.417 | 0.776 | 0.261 | 0.281 | 0.877 | 0.271 | 0.650 | 0.359 | 0.388 | 1.111 |
| Pb | 0.011 | 0.009 | 0.011 | 0.003 | 0.011 | 0.011 | 0.011 | 0.011 | 0.009 | 0.017 | 0.000 | 0.000 | 0.009 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.005 | 0.000 | 0.002 | 0.008 | 0.014 | 0.013 | 0.014 | 0.017 | 0.006 | 0.008 | 0.012 | 0.021 | 0.008 |
| Sc | | | | 0.011 | 0.007 | 0.018 | 0.018 | 0.007 | 0.022 | 0.007 | 0.048 | 0.000 | 0.001 |
| Sb | | | | | | | | | | | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | | | | | | 0.000 | 0.000 | 0.000 |
| **Total** | 16.000 | 16.012 | 16.016 | 16.000 | 16.000 | 16.024 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| | | | | | | | | | | | | | |
| Comments: | QE & QM | | assoc. | 2 grains - both with variable tungsten content | | | | | | | | | |
| | same grain | | cass. | | BB - BK | | | | BE - BG | | | | |
| | | | | | same grain | | | | same grain | | | | |
| | | | | | | | | | | | | | |
| | | ferrowodginite | | | | | | tungsteniferous wodginite | | | | | |

**Pegmatite 7**

94-Peg 7E

| Raw data | EA | EB | ED | BA1 | BA2 | BA3 | BA4 | BA5 | BA6 | BA7 | BA8 | BA9 | BA10 | BA11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 5.28 | 5.77 | 5.44 | 5.04 | 4.98 | 5.01 | 5.07 | 5.11 | 5.10 | 5.09 | 5.18 | 5.30 | 5.90 | 6.09 |
| MnO | 7.48 | 7.23 | 7.48 | 7.60 | 7.61 | 7.42 | 7.42 | 7.43 | 7.50 | 7.50 | 7.45 | 7.39 | 6.92 | 6.88 |
| TiO2 | 0.41 | 0.51 | 0.55 | 0.54 | 0.50 | 0.44 | 0.51 | 0.51 | 0.47 | 0.43 | 0.44 | 0.42 | 0.53 | 0.52 |
| Nb2O5 | 4.48 | 5.57 | 5.59 | 4.37 | 4.48 | 4.65 | 4.45 | 4.61 | 4.68 | 4.77 | 4.82 | 4.82 | 5.80 | 6.12 |
| Ta2O5 | 64.19 | 61.59 | 64.02 | 64.39 | 64.39 | 63.40 | 64.17 | 64.83 | 63.80 | 63.34 | 63.07 | 63.43 | 63.04 | 62.75 |
| SnO2 | 14.84 | 12.84 | 13.00 | 14.44 | 14.16 | 14.48 | 14.04 | 13.82 | 14.45 | 14.77 | 14.56 | 14.48 | 13.51 | 13.73 |
| WO3 | 3.63 | 5.19 | 3.57 | 3.24 | 3.10 | 3.37 | 3.31 | 3.05 | 3.26 | 3.67 | 3.57 | 3.54 | 3.02 | 3.03 |
| PbO | 0.04 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.07 | 0.00 | 0.04 | 0.06 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.11 | 0.09 | 0.19 | 0.13 | 0.11 | 0.06 | 0.15 | 0.00 | 0.00 | 0.00 | 0.19 | 0.08 | 0.00 | 0.09 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.01 | 0.00 |
| Total | 100.46 | 98.81 | 99.86 | 99.75 | 99.33 | 98.85 | 99.13 | 99.43 | 99.25 | 99.64 | 99.34 | 99.47 | 98.73 | 99.35 |

| Recalculated |  |  |  |  |  |  | 94-Peg 7E |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| oxides | EA | EB | ED | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA | V2 BA |
| Li2O | 0.12 | 0.17 | 0.14 | 0.11 | 0.12 | 0.14 | 0.13 | 0.16 | 0.14 | 0.15 | 0.11 | 0.13 | 0.13 | 0.10 |
| FeO | 3.18 | 3.12 | 3.10 | 3.01 | 2.90 | 2.96 | 3.02 | 2.94 | 2.96 | 2.97 | 3.15 | 3.16 | 3.58 | 3.82 |
| MnO | 7.48 | 7.23 | 7.48 | 7.60 | 7.61 | 7.42 | 7.42 | 7.43 | 7.50 | 7.50 | 7.45 | 7.39 | 6.92 | 6.88 |
| Fe2O3 | 2.31 | 2.89 | 2.56 | 2.22 | 2.27 | 2.23 | 2.24 | 2.37 | 2.33 | 2.32 | 2.21 | 2.34 | 2.53 | 2.49 |
| TiO2 | 0.41 | 0.51 | 0.55 | 0.54 | 0.50 | 0.44 | 0.51 | 0.51 | 0.47 | 0.43 | 0.44 | 0.42 | 0.53 | 0.52 |
| Nb2O5 | 4.48 | 5.57 | 5.59 | 4.37 | 4.48 | 4.65 | 4.45 | 4.61 | 4.68 | 4.77 | 4.82 | 4.82 | 5.80 | 6.12 |
| Ta2O5 | 64.19 | 61.59 | 64.02 | 64.39 | 64.39 | 63.40 | 64.17 | 64.83 | 63.80 | 63.34 | 63.07 | 63.43 | 63.04 | 62.75 |
| SnO2 | 14.84 | 12.84 | 13.00 | 14.44 | 14.16 | 14.48 | 14.04 | 13.82 | 14.45 | 14.77 | 14.56 | 14.48 | 13.51 | 13.73 |
| WO3 | 3.63 | 5.19 | 3.57 | 3.24 | 3.10 | 3.37 | 3.31 | 3.05 | 3.26 | 3.67 | 3.57 | 3.54 | 3.02 | 3.03 |
| PbO | 0.04 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.07 | 0.00 | 0.04 | 0.06 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.11 | 0.09 | 0.19 | 0.13 | 0.11 | 0.06 | 0.15 | 0.00 | 0.00 | 0.00 | 0.19 | 0.08 | 0.00 | 0.09 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.03 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.02 | 0.03 | 0.01 | 0.00 |
| Total | 100.77 | 99.23 | 100.22 | 100.06 | 99.65 | 99.19 | 99.45 | 99.79 | 99.59 | 99.98 | 99.64 | 99.80 | 99.08 | 99.67 |

**Structural formulae based on 32 oxygens**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.201 | 0.296 | 0.243 | 0.195 | 0.212 | 0.249 | 0.233 | 0.270 | 0.234 | 0.250 | 0.192 | 0.217 | 0.227 | 0.179 |
| Fe2+ | 1.126 | 1.113 | 1.097 | 1.076 | 1.041 | 1.067 | 1.085 | 1.053 | 1.062 | 1.059 | 1.128 | 1.127 | 1.281 | 1.354 |
| Mn | 2.668 | 2.590 | 2.660 | 2.730 | 2.745 | 2.684 | 2.683 | 2.677 | 2.704 | 2.691 | 2.680 | 2.656 | 2.489 | 2.456 |
| Fe3+ | 0.735 | 0.927 | 0.814 | 0.713 | 0.732 | 0.723 | 0.724 | 0.765 | 0.752 | 0.745 | 0.710 | 0.752 | 0.813 | 0.795 |
| Ti | 0.130 | 0.161 | 0.172 | 0.173 | 0.159 | 0.143 | 0.162 | 0.164 | 0.150 | 0.137 | 0.142 | 0.135 | 0.168 | 0.166 |
| Nb | 0.853 | 1.065 | 1.062 | 0.838 | 0.863 | 0.899 | 0.859 | 0.887 | 0.900 | 0.914 | 0.926 | 0.925 | 1.114 | 1.167 |
| Ta | 7.353 | 7.081 | 7.314 | 7.429 | 7.459 | 7.369 | 7.445 | 7.498 | 7.386 | 7.298 | 7.286 | 7.319 | 7.283 | 7.196 |
| Sn | 2.493 | 2.164 | 2.178 | 2.443 | 2.405 | 2.468 | 2.389 | 2.344 | 2.452 | 2.495 | 2.466 | 2.449 | 2.289 | 2.309 |
| W | 0.396 | 0.569 | 0.389 | 0.356 | 0.342 | 0.374 | 0.366 | 0.336 | 0.360 | 0.403 | 0.393 | 0.389 | 0.332 | 0.332 |
| Pb | 0.005 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.012 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.006 | 0.000 | 0.004 | 0.005 | 0.000 | 0.000 | 0.002 |
| Sc | 0.041 | 0.032 | 0.068 | 0.048 | 0.040 | 0.022 | 0.054 | 0.000 | 0.000 | 0.000 | 0.070 | 0.028 | 0.000 | 0.033 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.003 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.003 | 0.001 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: BA = traverse at 10 μm intervals

tungsteniferous wodginite

**Pegmatite 7**

94-Peg 7E

| **Raw data** | CA1 | CA2 | CA3 | CA4 | CA5 | CA6 | CA7 | CA8 | CA9 | CA10 | CA11 | CA12 | CA13 | CA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 5.09 | 5.06 | 4.97 | 5.11 | 4.97 | 5.06 | 5.24 | 5.45 | 6.00 | 6.17 | 6.05 | 6.11 | 6.00 | 5.88 |
| MnO | 7.67 | 7.71 | 7.51 | 7.66 | 7.39 | 7.56 | 7.33 | 7.23 | 6.98 | 6.87 | 6.93 | 6.87 | 6.92 | 6.92 |
| TiO2 | 0.59 | 0.51 | 0.45 | 0.48 | 0.49 | 0.44 | 0.41 | 0.44 | 0.53 | 0.50 | 0.51 | 0.52 | 0.44 | 0.48 |
| Nb2O5 | 4.43 | 4.49 | 4.30 | 4.41 | 4.24 | 4.55 | 4.56 | 4.73 | 6.07 | 6.16 | 6.00 | 5.91 | 5.83 | 5.97 |
| Ta2O5 | 64.42 | 64.16 | 63.97 | 64.20 | 64.01 | 63.31 | 63.30 | 63.53 | 62.80 | 62.58 | 62.72 | 62.04 | 62.00 | 61.89 |
| SnO2 | 14.17 | 14.08 | 14.76 | 13.94 | 14.64 | 14.51 | 14.53 | 14.43 | 13.64 | 13.65 | 13.57 | 13.70 | 13.89 | 13.69 |
| WO3 | 3.26 | 3.50 | 3.33 | 3.38 | 2.96 | 3.74 | 3.60 | 3.48 | 3.11 | 3.10 | 3.31 | 3.60 | 3.70 | 3.75 |
| PbO | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.07 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.05 | 0.15 | 0.04 | 0.03 | 0.00 | 0.00 | 0.13 | 0.15 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.05 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| Total | 99.81 | 99.56 | 99.44 | 99.24 | 98.78 | 99.18 | 98.99 | 99.51 | 99.33 | 99.03 | 99.09 | 98.84 | 98.87 | 98.59 |

| **Recalculated** | | | | | | | 94-Peg 7E | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| oxides | CA1 | CA2 | CA3 | CA4 | CA5 | CA6 | CA7 | CA8 | CA9 | CA10 | CA11 | CA12 | CA13 | CA14 |
| Li2O | 0.11 | 0.13 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.12 | 0.10 | 0.11 | 0.13 | 0.12 | 0.12 | 0.15 |
| FeO | 2.96 | 2.83 | 3.02 | 2.86 | 3.01 | 2.87 | 3.08 | 3.35 | 3.75 | 3.79 | 3.66 | 3.73 | 3.68 | 3.51 |
| MnO | 7.67 | 7.71 | 7.51 | 7.66 | 7.39 | 7.56 | 7.33 | 7.23 | 6.98 | 6.87 | 6.93 | 6.87 | 6.92 | 6.92 |
| Fe2O3 | 2.34 | 2.44 | 2.13 | 2.47 | 2.13 | 2.39 | 2.36 | 2.29 | 2.46 | 2.60 | 2.62 | 2.60 | 2.54 | 2.59 |
| TiO2 | 0.59 | 0.51 | 0.45 | 0.48 | 0.49 | 0.44 | 0.41 | 0.44 | 0.53 | 0.50 | 0.51 | 0.52 | 0.44 | 0.48 |
| Nb2O5 | 4.43 | 4.49 | 4.30 | 4.41 | 4.24 | 4.55 | 4.56 | 4.73 | 6.07 | 6.16 | 6.00 | 5.91 | 5.83 | 5.97 |
| Ta2O5 | 64.42 | 64.16 | 63.97 | 64.20 | 64.01 | 63.31 | 63.30 | 63.53 | 62.80 | 62.58 | 62.72 | 62.04 | 62.00 | 61.89 |
| SnO2 | 14.17 | 14.08 | 14.76 | 13.94 | 14.64 | 14.51 | 14.53 | 14.43 | 13.64 | 13.65 | 13.57 | 13.70 | 13.89 | 13.69 |
| WO3 | 3.26 | 3.50 | 3.33 | 3.38 | 2.96 | 3.74 | 3.60 | 3.48 | 3.11 | 3.10 | 3.31 | 3.60 | 3.70 | 3.75 |
| PbO | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.07 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.05 | 0.15 | 0.04 | 0.03 | 0.00 | 0.00 | 0.13 | 0.15 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.05 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 |
| Total | 100.13 | 99.90 | 99.74 | 99.58 | 99.09 | 99.53 | 99.33 | 99.82 | 99.64 | 99.37 | 99.44 | 99.18 | 99.21 | 98.96 |

**Structural formulae based on 32 oxygens**

| | CA1 | CA2 | CA3 | CA4 | CA5 | CA6 | CA7 | CA8 | CA9 | CA10 | CA11 | CA12 | CA13 | CA14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.192 | 0.215 | 0.207 | 0.207 | 0.223 | 0.244 | 0.243 | 0.200 | 0.176 | 0.195 | 0.219 | 0.208 | 0.204 | 0.258 |
| Fe2+ | 1.054 | 1.011 | 1.083 | 1.025 | 1.089 | 1.030 | 1.106 | 1.199 | 1.331 | 1.346 | 1.300 | 1.328 | 1.312 | 1.254 |
| Mn | 2.754 | 2.772 | 2.710 | 2.764 | 2.688 | 2.726 | 2.651 | 2.601 | 2.493 | 2.459 | 2.481 | 2.464 | 2.484 | 2.488 |
| Fe3+ | 0.750 | 0.783 | 0.688 | 0.798 | 0.694 | 0.771 | 0.764 | 0.737 | 0.785 | 0.833 | 0.838 | 0.835 | 0.813 | 0.832 |
| Ti | 0.188 | 0.162 | 0.145 | 0.154 | 0.157 | 0.140 | 0.131 | 0.141 | 0.167 | 0.158 | 0.161 | 0.166 | 0.141 | 0.152 |
| Nb | 0.849 | 0.862 | 0.829 | 0.850 | 0.822 | 0.876 | 0.881 | 0.907 | 1.157 | 1.177 | 1.146 | 1.132 | 1.116 | 1.145 |
| Ta | 7.425 | 7.406 | 7.409 | 7.443 | 7.474 | 7.334 | 7.350 | 7.334 | 7.199 | 7.192 | 7.207 | 7.147 | 7.144 | 7.142 |
| Sn | 2.394 | 2.382 | 2.506 | 2.369 | 2.506 | 2.464 | 2.474 | 2.443 | 2.293 | 2.300 | 2.286 | 2.315 | 2.346 | 2.316 |
| W | 0.358 | 0.385 | 0.367 | 0.373 | 0.329 | 0.413 | 0.398 | 0.383 | 0.340 | 0.339 | 0.362 | 0.395 | 0.406 | 0.413 |
| Pb | 0.000 | 0.001 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.006 | 0.005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | 0.025 | 0.020 | 0.056 | 0.014 | 0.010 | 0.000 | 0.000 | 0.046 | 0.054 | 0.001 | 0.000 | 0.000 | 0.033 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.005 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: CA traverse across crystal at 10 micron intervals

same grain as BA

tungsteniferous wodginite

**Pegmatite 7**

94-Peg 7E

| Raw data | CA15 | CA16 | CA17 | CA18 | CA19 | CA20 | CA21 | CA22 | CA23 | CA24 | CA25 | CA26 | CA27 | CA28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 5.98 | 5.95 | 5.88 | 5.70 | 6.10 | 5.98 | 5.95 | 5.90 | 5.97 | 5.94 | 6.08 | 6.02 | 6.11 | 6.06 |
| MnO | 6.89 | 7.00 | 7.02 | 7.16 | 6.88 | 6.96 | 6.94 | 6.95 | 7.04 | 6.89 | 6.80 | 7.08 | 6.92 | 6.90 |
| TiO2 | 0.53 | 0.49 | 0.51 | 0.39 | 0.59 | 0.60 | 0.55 | 0.63 | 0.68 | 0.59 | 0.61 | 0.61 | 0.61 | 0.58 |
| Nb2O5 | 6.02 | 5.61 | 5.83 | 5.76 | 5.96 | 6.01 | 5.68 | 5.82 | 5.62 | 5.85 | 5.83 | 5.95 | 5.94 | 5.90 |
| Ta2O5 | 62.67 | 61.34 | 61.71 | 60.74 | 62.93 | 63.07 | 63.04 | 63.72 | 64.04 | 63.68 | 63.63 | 63.74 | 64.05 | 64.36 |
| SnO2 | 13.50 | 12.96 | 13.38 | 14.04 | 13.30 | 13.15 | 12.92 | 12.95 | 12.73 | 13.00 | 12.69 | 12.71 | 12.66 | 12.86 |
| WO3 | 3.35 | 4.89 | 4.31 | 4.97 | 3.18 | 3.00 | 3.02 | 2.88 | 2.69 | 2.90 | 2.82 | 2.80 | 2.82 | 2.74 |
| PbO | 0.06 | 0.08 | 0.00 | 0.00 | 0.01 | 0.06 | 0.03 | 0.04 | 0.02 | 0.01 | 0.05 | 0.00 | 0.00 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.05 | 0.08 | 0.04 | 0.10 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.15 | 0.07 | 0.03 | 0.00 |
| Sc2O3 | 0.08 | 0.08 | 0.15 | 0.16 | 0.11 | 0.14 | 0.00 | 0.20 | 0.00 | 0.06 | 0.00 | 0.04 | 0.01 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 |
| Total | 99.08 | 98.45 | 98.92 | 98.95 | 99.15 | 98.97 | 98.16 | 99.09 | 98.94 | 98.92 | 98.73 | 99.01 | 99.16 | 99.42 |

94-Peg 7E

| Recalculated oxides | CA15 | CA16 | CA17 | CA18 | CA19 | CA20 | CA21 | CA22 | CA23 | CA24 | CA25 | CA26 | CA27 | CA28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.13 | 0.16 | 0.14 | 0.15 | 0.11 | 0.11 | 0.12 | 0.12 | 0.11 | 0.14 | 0.13 | 0.11 | 0.13 | 0.14 |
| FeO | 3.66 | 3.35 | 3.50 | 3.33 | 3.78 | 3.69 | 3.53 | 3.67 | 3.56 | 3.61 | 3.69 | 3.57 | 3.64 | 3.64 |
| MnO | 6.89 | 7.00 | 7.02 | 7.16 | 6.88 | 6.96 | 6.94 | 6.95 | 7.04 | 6.89 | 6.80 | 7.08 | 6.92 | 6.90 |
| Fe2O3 | 2.53 | 2.83 | 2.59 | 2.59 | 2.53 | 2.51 | 2.65 | 2.43 | 2.64 | 2.54 | 2.62 | 2.69 | 2.70 | 2.65 |
| TiO2 | 0.53 | 0.49 | 0.51 | 0.39 | 0.59 | 0.60 | 0.55 | 0.63 | 0.68 | 0.59 | 0.61 | 0.61 | 0.61 | 0.58 |
| Nb2O5 | 6.02 | 5.61 | 5.83 | 5.76 | 5.96 | 6.01 | 5.68 | 5.82 | 5.62 | 5.85 | 5.83 | 5.95 | 5.94 | 5.90 |
| Ta2O5 | 62.67 | 61.34 | 61.71 | 60.74 | 62.93 | 63.07 | 63.04 | 63.72 | 64.04 | 63.68 | 63.63 | 63.74 | 64.05 | 64.36 |
| SnO2 | 13.50 | 12.96 | 13.38 | 14.04 | 13.30 | 13.15 | 12.92 | 12.95 | 12.73 | 13.00 | 12.69 | 12.71 | 12.66 | 12.86 |
| WO3 | 3.35 | 4.89 | 4.31 | 4.97 | 3.18 | 3.00 | 3.02 | 2.88 | 2.69 | 2.90 | 2.82 | 2.80 | 2.82 | 2.74 |
| PbO | 0.06 | 0.08 | 0.00 | 0.00 | 0.01 | 0.06 | 0.03 | 0.04 | 0.02 | 0.01 | 0.05 | 0.00 | 0.00 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.05 | 0.08 | 0.04 | 0.10 | 0.00 | 0.00 | 0.00 | 0.15 | 0.00 | 0.15 | 0.07 | 0.03 | 0.00 |
| Sc2O3 | 0.08 | 0.08 | 0.15 | 0.16 | 0.11 | 0.14 | 0.00 | 0.20 | 0.00 | 0.06 | 0.00 | 0.04 | 0.01 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 |
| Total | 99.42 | 98.85 | 99.27 | 99.31 | 99.48 | 99.29 | 98.51 | 99.40 | 99.28 | 99.27 | 99.09 | 99.36 | 99.52 | 99.79 |

**Structural formulae based on 32 oxygens**

| | CA15 | CA16 | CA17 | CA18 | CA19 | CA20 | CA21 | CA22 | CA23 | CA24 | CA25 | CA26 | CA27 | CA28 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.222 | 0.272 | 0.238 | 0.252 | 0.193 | 0.187 | 0.213 | 0.200 | 0.195 | 0.237 | 0.228 | 0.193 | 0.226 | 0.240 |
| Fe2+ | 1.303 | 1.200 | 1.247 | 1.185 | 1.345 | 1.312 | 1.271 | 1.307 | 1.272 | 1.288 | 1.320 | 1.270 | 1.296 | 1.291 |
| Mn | 2.468 | 2.519 | 2.515 | 2.563 | 2.461 | 2.494 | 2.513 | 2.489 | 2.531 | 2.474 | 2.447 | 2.537 | 2.478 | 2.466 |
| Fe3+ | 0.811 | 0.913 | 0.832 | 0.829 | 0.808 | 0.804 | 0.858 | 0.779 | 0.847 | 0.816 | 0.843 | 0.861 | 0.864 | 0.846 |
| Ti | 0.167 | 0.157 | 0.162 | 0.125 | 0.186 | 0.190 | 0.177 | 0.202 | 0.218 | 0.188 | 0.196 | 0.194 | 0.193 | 0.183 |
| Nb | 1.150 | 1.077 | 1.115 | 1.099 | 1.139 | 1.149 | 1.097 | 1.114 | 1.078 | 1.121 | 1.121 | 1.138 | 1.135 | 1.125 |
| Ta | 7.202 | 7.086 | 7.095 | 6.977 | 7.228 | 7.257 | 7.328 | 7.331 | 7.392 | 7.339 | 7.357 | 7.336 | 7.361 | 7.384 |
| Sn | 2.274 | 2.195 | 2.256 | 2.365 | 2.240 | 2.218 | 2.202 | 2.184 | 2.154 | 2.196 | 2.151 | 2.145 | 2.134 | 2.163 |
| W | 0.366 | 0.538 | 0.472 | 0.544 | 0.348 | 0.329 | 0.334 | 0.316 | 0.295 | 0.319 | 0.311 | 0.307 | 0.309 | 0.300 |
| Pb | 0.007 | 0.009 | 0.000 | 0.000 | 0.001 | 0.007 | 0.004 | 0.004 | 0.002 | 0.001 | 0.006 | 0.000 | 0.000 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.005 | 0.008 | 0.003 | 0.009 | 0.000 | 0.000 | 0.000 | 0.015 | 0.000 | 0.014 | 0.006 | 0.003 | 0.000 |
| Sc | 0.029 | 0.029 | 0.056 | 0.057 | 0.041 | 0.053 | 0.000 | 0.075 | 0.000 | 0.021 | 0.000 | 0.014 | 0.002 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: CA traverse across crystal at 10 micron intervals

same grain as BA

tungsteniferous wodginite

**Pegmatite 7**

94-Peg 7E

| Raw data | CA29 | CA30 | CA31 | CA32 | CA33 | CA34 | CA35 | CA36 | CA37 | CA38 | CA39 | CA41 | CA42 | CA43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 5.99 | 5.84 | 5.92 | 5.98 | 6.02 | 5.96 | 5.97 | 5.88 | 5.93 | 5.88 | 5.77 | 5.38 | 5.57 | 5.62 |
| MnO | 7.05 | 6.86 | 6.96 | 7.01 | 7.03 | 6.91 | 7.04 | 7.01 | 6.98 | 6.99 | 7.32 | 7.40 | 7.33 | 7.33 |
| TiO2 | 0.60 | 0.64 | 0.58 | 0.55 | 0.63 | 0.63 | 0.63 | 0.63 | 0.59 | 0.61 | 0.57 | 0.56 | 0.53 | 0.49 |
| Nb2O5 | 5.92 | 5.78 | 5.74 | 5.74 | 5.71 | 5.81 | 5.69 | 5.72 | 5.83 | 5.69 | 5.96 | 5.63 | 5.66 | 5.63 |
| Ta2O5 | 64.10 | 64.58 | 64.33 | 64.02 | 64.19 | 64.33 | 64.23 | 64.13 | 64.57 | 64.14 | 62.78 | 63.15 | 63.03 | 63.36 |
| SnO2 | 12.83 | 12.91 | 12.96 | 12.87 | 12.86 | 12.84 | 12.79 | 12.92 | 12.84 | 12.92 | 12.93 | 13.19 | 13.03 | 13.19 |
| WO3 | 2.72 | 2.53 | 2.73 | 2.78 | 2.66 | 2.66 | 2.75 | 2.70 | 2.68 | 2.67 | 3.99 | 3.34 | 3.64 | 3.63 |
| PbO | 0.00 | 0.01 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.06 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.07 | 0.00 | 0.04 | 0.11 | 0.01 | 0.09 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.06 | 0.19 | 0.00 | 0.07 | 0.10 | 0.16 | 0.00 | 0.06 | 0.00 | 0.10 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 |
| Total | 99.21 | 99.23 | 99.22 | 99.01 | 99.36 | 99.33 | 99.18 | 99.06 | 99.58 | 99.11 | 99.34 | 98.71 | 98.79 | 99.39 |

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| Recalculated<br>oxides | CA29 | CA30 | CA31 | CA32 | CA33 | CA34 | CA35 | CA36 | CA37 | CA38 | CA39 | CA41 | CA42 | CA43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.13 | 0.16 | 0.14 | 0.13 | 0.10 | 0.12 | 0.12 | 0.12 | 0.13 | 0.11 | 0.15 | 0.14 | 0.15 | 0.14 |
| FeO | 3.55 | 3.56 | 3.55 | 3.54 | 3.66 | 3.72 | 3.54 | 3.56 | 3.59 | 3.63 | 3.18 | 3.05 | 3.09 | 3.22 |
| MnO | 7.05 | 6.86 | 6.96 | 7.01 | 7.03 | 6.91 | 7.04 | 7.01 | 6.98 | 6.99 | 7.32 | 7.40 | 7.33 | 7.33 |
| Fe2O3 | 2.67 | 2.48 | 2.59 | 2.67 | 2.58 | 2.44 | 2.66 | 2.53 | 2.55 | 2.46 | 2.82 | 2.55 | 2.71 | 2.63 |
| TiO2 | 0.60 | 0.64 | 0.58 | 0.55 | 0.63 | 0.63 | 0.63 | 0.63 | 0.59 | 0.61 | 0.57 | 0.56 | 0.53 | 0.49 |
| Nb2O5 | 5.92 | 5.78 | 5.74 | 5.74 | 5.71 | 5.81 | 5.69 | 5.72 | 5.83 | 5.69 | 5.96 | 5.63 | 5.66 | 5.63 |
| Ta2O5 | 64.10 | 64.58 | 64.33 | 64.02 | 64.19 | 64.33 | 64.23 | 64.13 | 64.57 | 64.14 | 62.78 | 63.15 | 63.03 | 63.36 |
| SnO2 | 12.83 | 12.91 | 12.96 | 12.87 | 12.86 | 12.84 | 12.79 | 12.92 | 12.84 | 12.92 | 12.93 | 13.19 | 13.03 | 13.19 |
| WO3 | 2.72 | 2.53 | 2.73 | 2.78 | 2.66 | 2.66 | 2.75 | 2.70 | 2.68 | 2.67 | 3.99 | 3.34 | 3.64 | 3.63 |
| PbO | 0.00 | 0.01 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.06 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.07 | 0.00 | 0.04 | 0.11 | 0.01 | 0.09 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.06 | 0.19 | 0.00 | 0.07 | 0.10 | 0.16 | 0.00 | 0.06 | 0.00 | 0.10 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.04 |
| Total | 99.56 | 99.59 | 99.58 | 99.37 | 99.69 | 99.65 | 99.54 | 99.40 | 99.93 | 99.43 | 99.74 | 99.07 | 99.18 | 99.75 |

**Structural formulae based on 32 oxygens**

| | CA29 | CA30 | CA31 | CA32 | CA33 | CA34 | CA35 | CA36 | CA37 | CA38 | CA39 | CA41 | CA42 | CA43 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.216 | 0.272 | 0.243 | 0.216 | 0.179 | 0.207 | 0.214 | 0.214 | 0.225 | 0.193 | 0.263 | 0.248 | 0.262 | 0.235 |
| Fe2+ | 1.262 | 1.269 | 1.264 | 1.264 | 1.301 | 1.323 | 1.262 | 1.271 | 1.275 | 1.294 | 1.128 | 1.090 | 1.103 | 1.145 |
| Mn | 2.522 | 2.459 | 2.492 | 2.518 | 2.516 | 2.470 | 2.524 | 2.515 | 2.493 | 2.507 | 2.609 | 2.662 | 2.635 | 2.620 |
| Fe3+ | 0.855 | 0.796 | 0.830 | 0.857 | 0.827 | 0.780 | 0.851 | 0.811 | 0.813 | 0.791 | 0.900 | 0.822 | 0.871 | 0.840 |
| Ti | 0.190 | 0.204 | 0.185 | 0.175 | 0.202 | 0.199 | 0.199 | 0.199 | 0.185 | 0.193 | 0.180 | 0.178 | 0.170 | 0.156 |
| Nb | 1.131 | 1.106 | 1.098 | 1.100 | 1.091 | 1.110 | 1.089 | 1.095 | 1.112 | 1.090 | 1.134 | 1.081 | 1.085 | 1.075 |
| Ta | 7.365 | 7.431 | 7.401 | 7.382 | 7.380 | 7.387 | 7.392 | 7.388 | 7.401 | 7.390 | 7.181 | 7.296 | 7.271 | 7.271 |
| Sn | 2.162 | 2.177 | 2.185 | 2.176 | 2.168 | 2.161 | 2.159 | 2.182 | 2.158 | 2.183 | 2.169 | 2.235 | 2.203 | 2.219 |
| W | 0.298 | 0.277 | 0.299 | 0.305 | 0.292 | 0.291 | 0.302 | 0.296 | 0.293 | 0.293 | 0.435 | 0.368 | 0.400 | 0.397 |
| Pb | 0.000 | 0.001 | 0.000 | 0.002 | 0.004 | 0.000 | 0.000 | 0.000 | 0.007 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.007 | 0.000 | 0.004 | 0.010 | 0.001 | 0.008 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.002 | 0.000 | 0.023 | 0.069 | 0.000 | 0.027 | 0.038 | 0.059 | 0.000 | 0.020 | 0.000 | 0.038 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: CA traverse across crystal at 10 micron intervals

same grain as BA

tungsteniferous wodginite

| | | | | **Pegmatite 7** | | | | | | | **Pegmatite 7** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 94-Peg 7E | | | | | | | 94-Peg 7X | | |
| Raw data | CA44 | CA45 | CA46 | CA47 | CA48 | CA49 | CA50 | CA51 | CA52 | NK | NN | LL | LM |
| FeO | 5.43 | 5.39 | 5.49 | 5.43 | 5.27 | 5.11 | 5.19 | 5.26 | 5.24 | 10.30 | 10.04 | 10.61 | 11.18 |
| MnO | 7.31 | 7.34 | 7.36 | 7.53 | 7.44 | 7.61 | 7.52 | 7.18 | 7.16 | 4.22 | 4.39 | 3.78 | 3.93 |
| TiO2 | 0.51 | 0.52 | 0.51 | 0.51 | 0.54 | 0.36 | 0.39 | 0.46 | 0.45 | 0.75 | 0.89 | 1.24 | 1.15 |
| Nb2O5 | 5.53 | 5.42 | 5.51 | 5.29 | 5.40 | 4.55 | 4.49 | 4.62 | 4.61 | 10.66 | 8.43 | 13.93 | 13.69 |
| Ta2O5 | 62.94 | 63.17 | 63.53 | 63.98 | 63.58 | 62.53 | 61.52 | 63.18 | 63.07 | 55.18 | 56.67 | 49.17 | 46.55 |
| SnO2 | 13.00 | 12.98 | 13.08 | 13.41 | 13.40 | 14.34 | 14.09 | 14.00 | 14.61 | 12.16 | 12.06 | 10.71 | 10.27 |
| WO3 | 3.57 | 3.54 | 3.62 | 3.47 | 3.50 | 4.46 | 5.46 | 4.30 | 3.56 | 4.28 | 4.90 | 8.91 | 11.80 |
| PbO | 0.09 | 0.05 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.00 | 0.21 | 0.03 | 0.03 | 0.03 | 0.09 | 0.02 | 0.01 | 0.09 | 0.11 | 0.00 | 0.03 |
| Sc2O3 | 0.14 | 0.00 | 0.00 | 0.00 | 0.07 | 0.21 | 0.00 | 0.01 | 0.02 | 0.15 | 0.21 | 0.75 | 0.88 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.03 | 0.07 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.03 |
| Total | 98.53 | 98.45 | 99.37 | 99.66 | 99.22 | 99.20 | 98.79 | 99.02 | 98.74 | 97.87 | 97.80 | 99.10 | 99.64 |

| Recalculated | | | | 94-Peg 7E | | | | | | | 94-Peg7X | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| oxides | CA44 | CA45 | CA46 | CA47 | CA48 | CA49 | CA50 | CA51 | CA52 | PU | PV | LL | LM |
| Li2O | 0.14 | 0.16 | 0.16 | 0.14 | 0.16 | 0.12 | 0.18 | 0.19 | 0.15 | 0.00 | 0.00 | 0.16 | 0.14 |
| FeO | 3.09 | 2.97 | 3.06 | 3.01 | 2.98 | 2.91 | 2.73 | 3.01 | 3.18 | 7.23 | 6.99 | 7.42 | 7.44 |
| MnO | 7.31 | 7.34 | 7.36 | 7.53 | 7.44 | 7.61 | 7.52 | 7.18 | 7.16 | 4.22 | 4.39 | 3.78 | 3.93 |
| Fe2O3 | 2.55 | 2.65 | 2.65 | 2.66 | 2.50 | 2.41 | 2.69 | 2.46 | 2.25 | 3.36 | 3.33 | 3.40 | 4.00 |
| TiO2 | 0.51 | 0.52 | 0.51 | 0.51 | 0.54 | 0.36 | 0.39 | 0.46 | 0.45 | 0.75 | 0.89 | 1.24 | 1.15 |
| Nb2O5 | 5.53 | 5.42 | 5.51 | 5.29 | 5.40 | 4.55 | 4.49 | 4.62 | 4.61 | 10.66 | 8.43 | 13.93 | 13.69 |
| Ta2O5 | 62.94 | 63.17 | 63.53 | 63.98 | 63.58 | 62.53 | 61.52 | 63.18 | 63.07 | 55.18 | 56.67 | 49.17 | 46.55 |
| SnO2 | 13.00 | 12.98 | 13.08 | 13.41 | 13.40 | 14.34 | 14.09 | 14.00 | 14.61 | 12.16 | 12.06 | 10.71 | 10.27 |
| WO3 | 3.57 | 3.54 | 3.62 | 3.47 | 3.50 | 4.46 | 5.46 | 4.30 | 3.56 | 4.28 | 4.90 | 8.91 | 11.80 |
| PbO | 0.09 | 0.05 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.08 | 0.08 | 0.00 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.00 | 0.21 | 0.03 | 0.03 | 0.03 | 0.09 | 0.02 | 0.01 | 0.09 | 0.11 | 0.00 | 0.03 |
| Sc2O3 | 0.14 | 0.00 | 0.00 | 0.00 | 0.07 | 0.21 | 0.00 | 0.01 | 0.02 | 0.15 | 0.21 | 0.75 | 0.88 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.03 | 0.07 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.03 |
| Total | 98.88 | 98.83 | 99.76 | 100.03 | 99.59 | 99.53 | 99.20 | 99.42 | 99.08 | 98.17 | 98.09 | 99.48 | 100.04 |

**Structural formulae based on 32 oxygens**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.245 | 0.274 | 0.274 | 0.239 | 0.271 | 0.214 | 0.303 | 0.332 | 0.260 | 0.003 | 0.000 | 0.260 | 0.223 |
| Fe2+ | 1.109 | 1.067 | 1.092 | 1.067 | 1.063 | 1.042 | 0.981 | 1.079 | 1.147 | 2.511 | 2.456 | 2.479 | 2.463 |
| Mn | 2.636 | 2.653 | 2.634 | 2.692 | 2.667 | 2.742 | 2.716 | 2.589 | 2.593 | 1.477 | 1.554 | 1.262 | 1.302 |
| Fe3+ | 0.825 | 0.856 | 0.848 | 0.849 | 0.801 | 0.776 | 0.870 | 0.793 | 0.728 | 1.049 | 1.054 | 1.020 | 1.190 |
| Ti | 0.162 | 0.166 | 0.163 | 0.162 | 0.172 | 0.115 | 0.125 | 0.147 | 0.146 | 0.233 | 0.280 | 0.368 | 0.339 |
| Nb | 1.065 | 1.045 | 1.054 | 1.010 | 1.034 | 0.874 | 0.865 | 0.888 | 0.892 | 1.992 | 1.593 | 2.484 | 2.419 |
| Ta | 7.292 | 7.329 | 7.307 | 7.342 | 7.320 | 7.232 | 7.130 | 7.315 | 7.337 | 6.202 | 6.442 | 5.274 | 4.948 |
| Sn | 2.209 | 2.208 | 2.205 | 2.256 | 2.262 | 2.432 | 2.395 | 2.377 | 2.492 | 2.004 | 2.010 | 1.684 | 1.600 |
| W | 0.394 | 0.392 | 0.397 | 0.379 | 0.384 | 0.492 | 0.603 | 0.475 | 0.395 | 0.458 | 0.531 | 0.911 | 1.196 |
| Pb | 0.010 | 0.005 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.009 | 0.009 | 0.000 | 0.012 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.000 | 0.020 | 0.002 | 0.003 | 0.003 | 0.009 | 0.002 | 0.001 | 0.008 | 0.010 | 0.000 | 0.003 |
| Sc | 0.052 | 0.000 | 0.000 | 0.000 | 0.025 | 0.077 | 0.000 | 0.003 | 0.007 | 0.054 | 0.076 | 0.259 | 0.300 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| Bi | 0.000 | 0.004 | 0.008 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.003 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.019 | 16.000 | 16.000 |
| Comments: | | | | CA traverse across crystal at 10 micron intervals<br>same grain as BA | | | | | | | associated with large<br>cassiterite grains | | |
| | | | | tungsteniferous wodginite | | | | | | | ferrowodginite | | |

| | **Pegmatite 7** | | | | **Separation Rapids pluton** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-Peg 7X | | | | 96-72A | | | | | | | | |
| Raw data | LN | LO | LP | LQ | AA | AB | AC | AD | AE | AF | AG | AH | AK |
| FeO | 10.52 | 10.35 | 10.87 | 10.23 | 10.23 | 8.00 | 7.19 | 8.42 | 6.61 | 6.76 | 6.97 | 8.35 | 9.95 |
| MnO | 3.92 | 4.14 | 5.02 | 4.97 | 3.19 | 4.68 | 5.41 | 3.98 | 5.73 | 5.66 | 5.68 | 4.40 | 3.47 |
| TiO2 | 1.35 | 1.24 | 1.22 | 1.16 | 0.99 | 0.44 | 0.12 | 0.07 | 0.15 | 0.07 | 0.09 | 0.45 | 0.76 |
| Nb2O5 | 12.93 | 13.36 | 21.25 | 22.04 | 9.46 | 2.62 | 1.61 | 1.07 | 1.35 | 1.79 | 1.89 | 2.71 | 10.25 |
| Ta2O5 | 52.62 | 51.50 | 47.45 | 49.68 | 61.65 | 70.17 | 71.37 | 71.90 | 71.29 | 70.32 | 70.47 | 70.39 | 60.51 |
| SnO2 | 11.31 | 11.75 | 5.49 | 4.27 | 13.65 | 12.94 | 13.21 | 13.34 | 13.33 | 14.12 | 13.40 | 12.91 | 13.45 |
| WO3 | 6.57 | 7.32 | 8.26 | 6.55 | 0.62 | 0.58 | 0.44 | 0.41 | 0.53 | 0.38 | 0.46 | 0.59 | 0.71 |
| PbO | 0.04 | 0.07 | 0.11 | 0.23 | 0.05 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Sc2O3 | 0.54 | 0.54 | 0.43 | 0.41 | 0.00 | 0.10 | 0.08 | 0.15 | 0.00 | 0.00 | 0.00 | 0.14 | 0.05 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.03 | 0.01 | 0.09 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.06 | 0.04 | 0.00 | 0.00 | 0.00 |
| Total | 99.82 | 100.28 | 100.20 | 99.59 | 99.89 | 99.60 | 99.48 | 99.37 | 99.04 | 99.13 | 99.00 | 99.94 | 99.19 |
| Recalculated | 94-Peg7X | | | | 96-72A | | | | | | | | |
| oxides | LN | LO | LP | LQ | AA | AB | AC | AD | AE | AF | AG | AH | AK |
| Li2O | 0.10 | 0.12 | 0.27 | 0.36 | 0.04 | 0.07 | 0.07 | 0.07 | 0.09 | 0.07 | 0.06 | 0.07 | 0.05 |
| FeO | 7.55 | 7.32 | 6.21 | 5.72 | 8.15 | 5.97 | 5.13 | 6.46 | 4.59 | 4.82 | 4.83 | 6.28 | 7.77 |
| MnO | 3.92 | 4.14 | 5.02 | 4.97 | 3.19 | 4.68 | 5.41 | 3.98 | 5.73 | 5.66 | 5.68 | 4.40 | 3.47 |
| Fe2O3 | 3.20 | 3.26 | 5.02 | 4.83 | 2.31 | 2.26 | 2.29 | 2.14 | 2.21 | 2.12 | 2.35 | 2.25 | 2.39 |
| TiO2 | 1.35 | 1.24 | 1.22 | 1.16 | 0.99 | 0.44 | 0.12 | 0.07 | 0.15 | 0.07 | 0.09 | 0.45 | 0.76 |
| Nb2O5 | 12.93 | 13.36 | 21.25 | 22.04 | 9.46 | 2.62 | 1.61 | 1.07 | 1.35 | 1.79 | 1.89 | 2.71 | 10.25 |
| Ta2O5 | 52.62 | 51.50 | 47.45 | 49.68 | 61.65 | 70.17 | 71.37 | 71.90 | 71.29 | 70.32 | 70.47 | 70.39 | 60.51 |
| SnO2 | 11.31 | 11.75 | 5.49 | 4.27 | 13.65 | 12.94 | 13.21 | 13.34 | 13.33 | 14.12 | 13.40 | 12.91 | 13.45 |
| WO3 | 6.57 | 7.32 | 8.26 | 6.55 | 0.62 | 0.58 | 0.44 | 0.41 | 0.53 | 0.38 | 0.46 | 0.59 | 0.71 |
| PbO | 0.04 | 0.07 | 0.11 | 0.23 | 0.05 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 |
| Sc2O3 | 0.54 | 0.54 | 0.43 | 0.41 | 0.00 | 0.10 | 0.08 | 0.15 | 0.00 | 0.00 | 0.00 | 0.14 | 0.05 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.03 | 0.01 | 0.09 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.06 | 0.04 | 0.00 | 0.00 | 0.00 |
| Total | 100.15 | 100.62 | 100.82 | 100.27 | 100.11 | 99.83 | 99.73 | 99.61 | 99.32 | 99.38 | 99.27 | 100.19 | 99.44 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.157 | 0.184 | 0.419 | 0.554 | 0.072 | 0.121 | 0.118 | 0.126 | 0.167 | 0.118 | 0.102 | 0.114 | 0.089 |
| Fe2+ | 2.524 | 2.430 | 1.975 | 1.833 | 2.808 | 2.163 | 1.877 | 2.389 | 1.698 | 1.777 | 1.780 | 2.277 | 2.694 |
| Mn | 1.316 | 1.378 | 1.596 | 1.589 | 1.114 | 1.716 | 2.005 | 1.483 | 2.136 | 2.105 | 2.114 | 1.606 | 1.213 |
| Fe3+ | 0.962 | 0.974 | 1.436 | 1.393 | 0.717 | 0.737 | 0.756 | 0.712 | 0.737 | 0.704 | 0.780 | 0.734 | 0.744 |
| Ti | 0.403 | 0.365 | 0.345 | 0.329 | 0.306 | 0.142 | 0.040 | 0.022 | 0.048 | 0.022 | 0.031 | 0.145 | 0.236 |
| Nb | 2.316 | 2.375 | 3.604 | 3.760 | 1.761 | 0.512 | 0.319 | 0.213 | 0.269 | 0.355 | 0.375 | 0.528 | 1.914 |
| Ta | 5.670 | 5.508 | 4.840 | 5.097 | 6.907 | 8.269 | 8.498 | 8.606 | 8.538 | 8.399 | 8.415 | 8.256 | 6.797 |
| Sn | 1.786 | 1.843 | 0.821 | 0.642 | 2.243 | 2.235 | 2.306 | 2.342 | 2.340 | 2.472 | 2.346 | 2.220 | 2.215 |
| W | 0.675 | 0.747 | 0.803 | 0.640 | 0.066 | 0.065 | 0.050 | 0.047 | 0.060 | 0.043 | 0.052 | 0.066 | 0.075 |
| Pb | 0.004 | 0.008 | 0.011 | 0.024 | 0.005 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.004 | 0.002 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.185 | 0.186 | 0.141 | 0.136 | 0.000 | 0.037 | 0.030 | 0.058 | 0.000 | 0.000 | 0.000 | 0.051 | 0.016 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.003 | 0.001 | 0.009 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.007 | 0.004 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | LL - LQ cluster of ferrowodginite grains | | secondary between other ferrowodginite grains | | | | AA - AH large unzoned grain | | | | | | |
| | ferrowodginite | | | | | | ferrowodginite - wodginite grain | | | | | | |

|  | Separation Rapids pluton |  |  |  |  | Marko's | Marko's | Marko's pegmatite |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 96-72A |  |  |  |  | 96-AT3 | 96-AT5 | 96-AT8 |  |  |  |
| Raw data | AL | AM | AP | AQ | AR | AF | BG | EE | EF | EG | EP |
| FeO | 6.99 | 6.83 | 6.82 | 9.55 | 10.28 | 10.55 | 4.18 | 2.90 | 2.73 | 9.72 | 10.61 |
| MnO | 5.18 | 5.59 | 5.58 | 2.92 | 3.38 | 2.16 | 8.16 | 9.58 | 9.69 | 3.15 | 2.25 |
| TiO2 | 0.02 | 0.00 | .0.03 | 1.03 | 0.77 | 7.43 | 7.52 | 7.60 | 7.59 | 7.77 | 7.94 |
| Nb2O5 | 1.28 | 1.59 | 1.47 | 9.89 | 10.60 | 13.46 | 15.76 | 14.01 | 13.72 | 14.43 | 14.81 |
| Ta2O5 | 70.01 | 70.61 | 70.73 | 60.55 | 60.86 | 55.11 | 53.73 | 56.52 | 57.14 | 55.61 | 54.92 |
| SnO2 | 15.14 | 14.00 | 13.97 | 12.42 | 13.49 | 11.19 | 9.02 | 9.43 | 9.63 | 8.62 | 8.16 |
| WO3 | 0.58 | 0.49 | 0.44 | 0.62 | 0.65 | 0.09 | 0.33 | 0.08 | 0.13 | 0.05 | 0.04 |
| PbO | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 | 0.03 | 0.15 | 0.03 | 0.04 | 0.12 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 |  |  |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.05 | 0.00 | 1.07 | 0.09 | 0.21 | 0.35 | 0.11 | 0.12 | 0.13 | 0.24 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.20 | 99.15 | 99.05 | 98.18 | 100.12 | 100.24 | 100.75 | 100.25 | 100.89 | 99.67 | 99.03 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Recalculated | 96-72A |  |  |  |  | 96-AT3 | 96-AT7 | 96-AT8 |  |  |  |
| oxides | AL | AM | AP | AQ | AR | AF | BG | EE | EF | EG | EP |
| Li2O | 0.07 | 0.07 | 0.07 | 0.03 | 0.04 | 0.00 | 0.07 | 0.07 | 0.08 | 0.03 | 0.02 |
| FeO | 5.25 | 4.86 | 4.84 | 8.28 | 8.06 | 10.42 | 3.91 | 2.54 | 2.42 | 9.19 | 10.13 |
| MnO | 5.18 | 5.59 | 5.58 | 2.92 | 3.38 | 2.16 | 8.16 | 9.58 | 9.69 | 3.15 | 2.25 |
| Fe2O3 | 1.90 | 2.15 | 2.17 | 1.31 | 2.42 | 0.15 | 0.28 | 0.39 | 0.34 | 0.59 | 0.51 |
| TiO2 | 0.02 | 0.00 | 0.03 | 1.03 | 0.77 | 7.43 | 7.52 | 7.60 | 7.59 | 7.77 | 7.94 |
| Nb2O5 | 1.28 | 1.59 | 1.47 | 9.89 | 10.60 | 13.46 | 15.76 | 14.01 | 13.72 | 14.43 | 14.81 |
| Ta2O5 | 70.01 | 70.61 | 70.73 | 60.55 | 60.86 | 55.11 | 53.73 | 56.52 | 57.14 | 55.61 | 54.92 |
| SnO2 | 15.14 | 14.00 | 13.97 | 12.42 | 13.49 | 11.19 | 9.02 | 9.43 | 9.63 | 8.62 | 8.16 |
| WO3 | 0.58 | 0.49 | 0.44 | 0.62 | 0.65 | 0.09 | 0.33 | 0.08 | 0.13 | 0.05 | 0.04 |
| PbO | 0.00 | 0.00 | 0.00 | 0.05 | 0.01 | 0.03 | 0.15 | 0.03 | 0.04 | 0.12 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 |  |  |  | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.05 | 0.00 | 1.07 | 0.09 | 0.21 | 0.35 | 0.11 | 0.12 | 0.13 | 0.24 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.43 | 99.40 | 99.31 | 98.24 | 100.37 | 100.26 | 99.28 | 100.36 | 100.90 | 99.69 | 99.07 |
|  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |
| Li | 0.125 | 0.122 | 0.127 | 0.046 | 0.064 | 0.000 | 0.111 | 0.107 | 0.118 | 0.040 | 0.027 |
| Fe2+ | 1.941 | 1.797 | 1.790 | 2.916 | 2.765 | 3.326 | 1.248 | 0.807 | 0.768 | 2.930 | 3.240 |
| Mn | 1.933 | 2.081 | 2.083 | 1.032 | 1.171 | 0.698 | 2.625 | 3.083 | 3.110 | 1.017 | 0.726 |
| Fe3+ | 0.632 | 0.713 | 0.723 | 0.414 | 0.748 | 0.042 | 0.079 | 0.113 | 0.097 | 0.169 | 0.146 |
| Ti | 0.005 | 0.000 | 0.010 | 0.323 | 0.237 | 2.134 | 2.148 | 2.170 | 2.163 | 2.226 | 2.277 |
| Nb | 0.255 | 0.316 | 0.292 | 1.865 | 1.958 | 2.322 | 2.706 | 2.406 | 2.348 | 2.485 | 2.555 |
| Ta | 8.383 | 8.442 | 8.471 | 6.869 | 6.761 | 5.720 | 5.550 | 5.839 | 5.886 | 5.762 | 5.697 |
| Sn | 2.658 | 2.455 | 2.453 | 2.065 | 2.197 | 1.702 | 1.366 | 1.428 | 1.454 | 1.310 | 1.241 |
| W | 0.066 | 0.055 | 0.051 | 0.067 | 0.068 | 0.009 | 0.032 | 0.008 | 0.012 | 0.005 | 0.004 |
| Pb | 0.000 | 0.000 | 0.000 | 0.006 | 0.001 | 0.003 | 0.015 | 0.003 | 0.004 | 0.013 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 |  |  |  | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.019 | 0.000 | 0.390 | 0.031 | 0.069 | 0.117 | 0.036 | 0.039 | 0.044 | 0.081 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.027 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
|  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | AK - AR same grain |  |  |  |  | incl. in | incl. in | EE & EF same incl. |  |  |  |
|  | intergrown but earlier than ferrotapiolite |  |  |  |  | cassiterite | cassiterite | all are inclusions in cassiterite |  |  |  |
|  |  |  |  |  |  |  |  | also contains microlite incls. |  |  |  |
|  |  |  |  |  |  |  | Ti wodginite |  |  |  |  |
|  | ferrowodginite - wodginite grain |  |  |  |  | Fe-Ti wodginite |  | Ti wodginite |  | Fe-Ti wodginite |  |

|  | Marko's pegmatite |  |  |  | Marko's pegmatite |  |  |  |  | Marko's pegmatite |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 96-AT11A |  |  |  | 96-AT12 |  |  |  |  | 96-AT17 |  |  |  |
| Raw data | QF | QJ | QK | QL | GF | GK | GL | GI | GJ | RA | RB | RC | RD |
| FeO | 10.66 | 9.26 | 8.35 | 8.19 | 7.12 | 6.81 | 2.88 | 10.65 | 10.50 | 10.99 | 10.82 | 10.39 | 10.62 |
| MnO | 2.16 | 3.75 | 4.57 | 4.71 | 6.13 | 5.88 | 9.38 | 2.44 | 2.85 | 2.09 | 2.26 | 2.19 | 2.27 |
| TiO2 | 7.42 | 7.92 | 7.90 | 7.77 | 7.67 | 8.12 | 7.24 | 7.86 | 7.97 | 7.73 | 7.54 | 7.27 | 7.66 |
| Nb2O5 | 14.55 | 15.69 | 15.31 | 15.29 | 13.95 | 14.60 | 13.65 | 16.71 | 16.19 | 12.92 | 13.14 | 14.03 | 13.09 |
| Ta2O5 | 55.46 | 54.92 | 54.86 | 54.84 | 55.33 | 55.31 | 56.36 | 52.46 | 52.58 | 57.78 | 57.91 | 56.67 | 57.46 |
| SnO2 | 8.58 | 8.25 | 8.27 | 8.37 | 8.68 | 7.59 | 9.25 | 8.05 | 8.10 | 8.64 | 8.64 | 8.88 | 8.65 |
| WO3 | 0.05 | 0.07 | 0.06 | 0.11 | 0.19 | 0.24 | 0.42 | 0.13 | 0.08 | 0.12 | 0.11 | 0.09 | 0.09 |
| PbO | 0.00 | 0.06 | 0.05 | 0.09 | 0.07 | 0.04 | 0.00 | 0.17 | 0.06 | 0.01 | 0.02 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.21 | 0.38 | 0.31 | 0.35 | 0.34 | 0.25 | 0.29 | 0.28 | 0.22 | 0.30 | 0.18 | 0.14 | 0.16 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 99.14 | 100.30 | 99.68 | 99.72 | 99.50 | 98.84 | 99.47 | 98.74 | 98.55 | 100.58 | 100.60 | 99.67 | 100.02 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Recalculated | 96-AT11A |  |  |  | 96-AT12 |  |  |  |  | 96-AT17 |  |  |  |
| oxides | QF | QJ | QK | QL | GF | GK | GL | GI | GJ | RA | RB | RC | RD |
| Li2O | 0.05 | 0.02 | 0.02 | 0.02 | 0.00 | 0.04 | [illegible] | 0.01 | 0.00 | 0.00 | 0.01 | 0.08 | 0.02 |
| FeO | 10.06 | 8.82 | 7.89 | 7.74 | 6.49 | 6.33 | 2.55 | 10.05 | 9.79 | 10.46 | 10.18 | 9.85 | 10.07 |
| MnO | 2.06 | 3.75 | 4.57 | 4.71 | 6.13 | 5.88 | 9.38 | 2.44 | 2.85 | 2.09 | 2.26 | 2.19 | 2.27 |
| Fe2O3 | 0.52 | 0.46 | 0.48 | 0.48 | 0.68 | 0.51 | 0.35 | 0.63 | 0.76 | 0.56 | 0.69 | 0.57 | 0.58 |
| TiO2 | 7.42 | 7.92 | 7.90 | 7.77 | 7.67 | 8.12 | 7.24 | 7.86 | 7.97 | 7.73 | 7.54 | 7.27 | 7.66 |
| Nb2O5 | 14.45 | 15.69 | 15.31 | 15.29 | 13.95 | 14.60 | 13.65 | 16.71 | 16.19 | 12.92 | 13.14 | 14.03 | 13.09 |
| Ta2O5 | 55.36 | 54.92 | 54.86 | 54.84 | 55.33 | 55.31 | 56.36 | 52.46 | 52.58 | 57.78 | 57.91 | 56.67 | 57.46 |
| SnO2 | 8.58 | 8.25 | 8.27 | 8.37 | 8.68 | 7.59 | 9.25 | 8.05 | 8.10 | 8.64 | 8.64 | 8.88 | 8.65 |
| WO3 | 0.05 | 0.07 | 0.06 | 0.11 | 0.19 | 0.24 | 0.42 | 0.13 | 0.08 | 0.12 | 0.11 | 0.09 | 0.09 |
| PbO | 0.00 | 0.06 | 0.05 | 0.09 | 0.07 | 0.04 | 0.00 | 0.17 | 0.06 | 0.01 | 0.02 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.21 | 0.38 | 0.31 | 0.35 | 0.34 | 0.25 | 0.29 | 0.28 | 0.22 | 0.30 | 0.18 | 0.14 | 0.16 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 98.81 | 100.33 | 99.72 | 99.76 | 99.55 | 98.92 | 99.58 | 98.79 | 98.60 | 100.61 | 100.66 | 99.77 | 100.08 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.080 | 0.023 | 0.026 | 0.024 | 0.000 | 0.069 | 0.125 | 0.011 | 0.000 | 0.000 | 0.021 | 0.125 | 0.035 |
| Fe2+ | 3.247 | 2.777 | 2.504 | 2.456 | 2.076 | 2.026 | 0.823 | 3.191 | 3.114 | 3.339 | 3.249 | 3.164 | 3.228 |
| Mn | 0.672 | 1.193 | 1.465 | 1.511 | 1.980 | 1.901 | 3.052 | 0.781 | 0.916 | 0.675 | 0.729 | 0.711 | 0.737 |
| Fe3+ | 0.152 | 0.129 | 0.138 | 0.136 | 0.196 | 0.148 | 0.101 | 0.180 | 0.217 | 0.160 | 0.197 | 0.164 | 0.169 |
| Ti | 2.146 | 2.235 | 2.248 | 2.212 | 2.200 | 2.330 | 2.091 | 2.239 | 2.275 | 2.212 | 2.161 | 2.093 | 2.204 |
| Nb | 2.513 | 2.663 | 2.617 | 2.616 | 2.407 | 2.520 | 2.369 | 2.860 | 2.778 | 2.224 | 2.262 | 2.429 | 2.265 |
| Ta | 5.793 | 5.607 | 5.643 | 5.646 | 5.742 | 5.741 | 5.884 | 5.401 | 5.425 | 5.982 | 5.998 | 5.901 | 5.979 |
| Sn | 1.317 | 1.234 | 1.247 | 1.263 | 1.321 | 1.156 | 1.416 | 1.215 | 1.226 | 1.312 | 1.312 | 1.356 | 1.319 |
| W | 0.005 | 0.007 | 0.006 | 0.010 | 0.019 | 0.024 | 0.042 | 0.013 | 0.008 | 0.012 | 0.011 | 0.009 | 0.009 |
| Pb | 0.000 | 0.006 | 0.005 | 0.009 | 0.007 | 0.004 | 0.000 | 0.017 | 0.006 | 0.001 | 0.002 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| Sc | 0.071 | 0.124 | 0.101 | 0.116 | 0.114 | 0.081 | 0.097 | 0.091 | 0.072 | 0.099 | 0.058 | 0.047 | 0.053 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.063 | 16.000 | 16.000 | 16.000 | 16.036 | 16.014 | 16.000 | 16.000 | 16.000 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | QJ - QL same incl.<br>all are inclusions in cassiterite<br>also contains microlite incls.<br>all Fe-Ti wodginite |  |  |  | GF & GK same incl.<br>all are inclusions in cassiterite<br>Ti wodginite<br>Fe-Ti wodginite |  |  | GI & GJ same incl.<br>Fe-Ti wodginite |  | RA - RF same incl.<br>euhedral zoned inclusion<br>in cassiterite<br>with extreme FeTi composition<br>all ferrotitanowodginite |  |  |  |

| | Marko's | | | | | | Marko's pegmatite | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT17 | | | | | | 96-AT19B | | | | | | |
| **Raw data** | RE | RF | DA | DD | DF | DG | DH | DJ | DL | DM | DN | DT | DW |
| FeO | 10.83 | 10.90 | 4.36 | 2.31 | 2.70 | 2.80 | 2.58 | 4.93 | 2.62 | 2.57 | 2.25 | 2.84 | 4.90 |
| MnO | 2.03 | 2.01 | 8.08 | 9.77 | 9.20 | 9.44 | 9.52 | 8.87 | 9.27 | 9.38 | 9.88 | 9.21 | 7.15 |
| TiO2 | 7.70 | 7.67 | 1.42 | 1.17 | 0.87 | 1.10 | 0.96 | 1.15 | 0.94 | 0.81 | 1.11 | 0.81 | 2.53 |
| Nb2O5 | 12.96 | 14.35 | 7.43 | 7.34 | 6.34 | 6.51 | 8.07 | 14.02 | 7.32 | 6.85 | 7.79 | 6.67 | 7.90 |
| Ta2O5 | 57.70 | 56.51 | 63.55 | 64.10 | 64.97 | 64.58 | 62.76 | 62.56 | 63.53 | 63.58 | 62.43 | 63.46 | 62.53 |
| SnO2 | 8.57 | 8.70 | 14.77 | 14.71 | 15.56 | 15.64 | 15.87 | 7.33 | 15.99 | 16.65 | 15.91 | 15.39 | 14.09 |
| WO3 | 0.16 | 0.11 | 0.72 | 0.00 | 0.28 | 0.47 | 0.44 | 0.15 | 0.08 | 0.55 | 0.25 | 0.49 | 0.23 |
| PbO | 0.00 | 0.11 | 0.00 | 0.26 | 0.12 | 0.09 | 0.00 | 0.59 | 0.04 | 0.00 | 0.66 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.01 | 0.00 | 0.00 | 0.11 | 0.18 | 0.08 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.48 | 0.47 |
| Sc2O3 | 0.28 | 0.20 | 0.00 | 0.01 | 0.00 | 0.00 | 0.24 | 0.86 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.17 | 0.00 | 0.16 | 0.00 | 0.12 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.25 | 100.55 | 100.48 | 99.76 | 100.39 | 100.71 | 100.56 | 100.55 | 99.97 | 100.39 | 100.28 | 99.36 | 99.80 |
| | | | | | | | | | | | | | |
| **Recalculated** | 96-AT17 | | | | | | 96-AT19B | | | | | | |
| **oxides** | RE | RF | DA | DD | DF | DG | DH | DJ | DL | DM | DN | DT | DW |
| Li2O | 0.02 | 0.04 | 0.09 | 0.11 | 0.12 | 0.09 | 0.09 | 0.09 | 0.11 | 0.12 | 0.07 | 0.11 | 0.08 |
| FeO | 10.37 | 10.37 | 2.91 | 0.93 | 1.44 | 1.45 | 1.47 | 2.34 | 1.49 | 1.39 | 0.94 | 1.47 | 3.81 |
| MnO | 2.03 | 2.01 | 8.08 | 9.77 | 9.20 | 9.44 | 9.52 | 8.87 | 9.27 | 9.38 | 9.88 | 9.21 | 7.15 |
| Fe2O3 | 0.49 | 0.56 | 1.59 | 1.52 | 1.38 | 1.49 | 1.22 | 2.82 | 1.24 | 1.30 | 1.45 | 1.51 | 1.20 |
| TiO2 | 7.70 | 7.67 | 1.42 | 1.17 | 0.87 | 1.10 | 0.96 | 1.15 | 0.94 | 0.81 | 1.11 | 0.81 | 2.53 |
| Nb2O5 | 12.96 | 14.35 | 7.43 | 7.34 | 6.34 | 6.51 | 8.07 | 14.02 | 7.32 | 6.85 | 7.79 | 6.67 | 7.90 |
| Ta2O5 | 57.70 | 56.51 | 63.55 | 64.10 | 64.97 | 64.58 | 62.76 | 62.56 | 63.53 | 63.58 | 62.43 | 63.46 | 62.53 |
| SnO2 | 8.57 | 8.70 | 14.77 | 14.71 | 15.56 | 15.64 | 15.87 | 7.33 | 15.99 | 16.65 | 15.91 | 15.39 | 14.09 |
| WO3 | 0.16 | 0.11 | 0.72 | 0.00 | 0.28 | 0.47 | 0.44 | 0.15 | 0.08 | 0.55 | 0.25 | 0.49 | 0.23 |
| PbO | 0.00 | 0.11 | 0.00 | 0.26 | 0.12 | 0.09 | 0.00 | 0.59 | 0.04 | 0.00 | 0.66 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.01 | 0.00 | 0.00 | 0.11 | 0.18 | 0.08 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.48 | 0.47 |
| Sc2O3 | 0.28 | 0.20 | 0.00 | 0.01 | 0.00 | 0.00 | 0.24 | 0.86 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.17 | 0.00 | 0.16 | 0.00 | 0.12 | 0.00 | 0.12 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 100.28 | 100.62 | 100.72 | 100.02 | 100.64 | 100.94 | 100.76 | 100.88 | 100.19 | 100.63 | 100.48 | 99.60 | 99.99 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.023 | 0.058 | 0.159 | 0.184 | 0.207 | 0.155 | 0.155 | 0.152 | 0.189 | 0.200 | 0.116 | 0.180 | 0.135 |
| Fe2+ | 3.320 | 3.288 | 1.010 | 0.326 | 0.508 | 0.507 | 0.512 | 0.788 | 0.523 | 0.487 | 0.328 | 0.522 | 1.315 |
| Mn | 0.656 | 0.643 | 2.831 | 3.461 | 3.271 | 3.327 | 3.333 | 2.996 | 3.283 | 3.313 | 3.482 | 3.298 | 2.491 |
| Fe3+ | 0.140 | 0.159 | 0.496 | 0.482 | 0.439 | 0.468 | 0.381 | 0.856 | 0.392 | 0.410 | 0.457 | 0.482 | 0.372 |
| Ti | 2.213 | 2.183 | 0.440 | 0.369 | 0.275 | 0.344 | 0.297 | 0.345 | 0.297 | 0.254 | 0.346 | 0.257 | 0.782 |
| Nb | 2.237 | 2.455 | 1.388 | 1.388 | 1.203 | 1.225 | 1.508 | 2.527 | 1.384 | 1.292 | 1.466 | 1.275 | 1.470 |
| Ta | 5.993 | 5.814 | 7.146 | 7.295 | 7.414 | 7.310 | 7.052 | 6.783 | 7.223 | 7.214 | 7.065 | 7.294 | 6.997 |
| Sn | 1.306 | 1.313 | 2.434 | 2.454 | 2.604 | 2.596 | 2.614 | 1.165 | 2.666 | 2.769 | 2.639 | 2.594 | 2.311 |
| W | 0.016 | 0.011 | 0.077 | 0.000 | 0.031 | 0.050 | 0.047 | 0.016 | 0.009 | 0.059 | 0.027 | 0.053 | 0.025 |
| Pb | 0.000 | 0.011 | 0.000 | 0.029 | 0.014 | 0.010 | 0.000 | 0.064 | 0.005 | 0.000 | 0.074 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.010 | 0.016 | 0.007 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.045 | 0.043 |
| Sc | 0.094 | 0.065 | 0.000 | 0.003 | 0.000 | 0.000 | 0.087 | 0.300 | 0.015 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.018 | 0.000 | 0.017 | 0.000 | 0.013 | 0.000 | 0.013 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| | | | | | | | | | | | | | |
| Comments: | | | | | | | these are not inclusions in cassiterite<br>marginal replacement by microlite in DA & DT | | | | | | |
| | | | | | | | | | | | | | |
| | Fe-Ti wodginite | | | | | | all wodginite | | | | | | |

**Pegmatite 5**

96-AT23

| Raw data | NF | NG | NH | NU | NV | NJ | NN | NO | NP | NQ | NR | PA | PB | PC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 11.65 | 11.73 | 11.19 | 11.04 | 11.45 | 11.40 | 11.99 | 11.24 | 11.43 | 11.26 | 11.01 | 12.65 | 12.13 | 11.58 |
| MnO | 4.41 | 4.40 | 4.48 | 4.34 | 4.32 | 4.76 | 4.94 | 4.63 | 4.69 | 4.56 | 4.55 | 5.06 | 4.77 | 4.55 |
| TiO2 | 1.77 | 1.95 | 2.00 | 1.92 | 1.91 | 1.97 | 1.51 | 2.17 | 1.95 | 1.99 | 2.29 | 1.68 | 1.69 | 2.29 |
| Nb2O5 | 16.87 | 17.54 | 17.80 | 17.20 | 17.19 | 17.08 | 15.85 | 18.71 | 17.97 | 18.38 | 19.02 | 15.31 | 15.37 | 16.85 |
| Ta2O5 | 37.48 | 38.21 | 38.53 | 37.84 | 37.15 | 36.87 | 32.95 | 38.95 | 37.48 | 38.24 | 39.96 | 31.23 | 31.81 | 39.72 |
| SnO2 | 9.34 | 9.66 | 9.49 | 9.63 | 9.73 | 9.61 | 8.84 | 9.75 | 9.62 | 9.88 | 9.90 | 8.57 | 8.48 | 9.57 |
| WO3 | 16.43 | 15.05 | 14.76 | 15.38 | 15.98 | 16.22 | 22.48 | 13.35 | 15.37 | 14.26 | 11.91 | 24.10 | 23.14 | 12.99 |
| PbO | 0.11 | 0.05 | 0.08 | 0.10 | 0.10 | 0.12 | 0.07 | 0.09 | 0.11 | 0.13 | 0.07 | 0.09 | 0.03 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.01 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.10 | 0.01 |
| Sc2O3 | 0.32 | 0.42 | 0.60 | 0.69 | 0.61 | 0.36 | 0.20 | 0.35 | 0.38 | 0.39 | 0.47 | 0.29 | 0.84 | 0.39 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total | 98.37 | 99.02 | 98.93 | 98.23 | 98.42 | 98.41 | 98.84 | 99.28 | 98.99 | 99.08 | 99.20 | 99.01 | 98.35 | 98.11 |

96-AT23

| Recalculated oxides | NF | NG | NH | NU | NV | NJ | NN | NO | NP | NQ | NR | PA | PB | PC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.24 | 0.19 | 0.22 | 0.23 | 0.22 | 0.20 | 0.33 | 0.20 | 0.21 | 0.22 | 0.18 | 0.25 | 0.24 | 0.10 |
| FeO | 6.77 | 7.14 | 6.89 | 6.84 | 7.00 | 6.64 | 5.95 | 6.96 | 6.78 | 6.87 | 7.11 | 6.25 | 6.48 | 7.28 |
| MnO | 4.41 | 4.40 | 4.48 | 4.34 | 4.32 | 4.76 | 4.94 | 4.63 | 4.69 | 4.56 | 4.55 | 5.06 | 4.77 | 4.55 |
| Fe2O3 | 5.27 | 4.94 | 4.61 | 4.49 | 4.77 | 5.14 | 6.51 | 4.62 | 5.02 | 4.73 | 4.20 | 6.92 | 6.06 | 4.67 |
| TiO2 | 1.77 | 1.95 | 2.00 | 1.92 | 1.91 | 1.97 | 1.51 | 2.17 | 1.95 | 1.99 | 2.29 | 1.68 | 1.69 | 2.29 |
| Nb2O5 | 16.87 | 17.54 | 17.80 | 17.20 | 17.19 | 17.08 | 15.85 | 18.71 | 17.97 | 18.38 | 19.02 | 15.31 | 15.37 | 16.85 |
| Ta2O5 | 37.48 | 38.21 | 38.53 | 37.84 | 37.15 | 36.87 | 32.95 | 38.95 | 37.48 | 38.24 | 39.96 | 31.23 | 31.81 | 39.72 |
| SnO2 | 9.34 | 9.66 | 9.49 | 9.63 | 9.73 | 9.61 | 8.84 | 9.75 | 9.62 | 9.88 | 9.90 | 8.57 | 8.48 | 9.57 |
| WO3 | 16.43 | 15.05 | 14.76 | 15.38 | 15.98 | 16.22 | 22.48 | 13.35 | 15.37 | 14.26 | 11.91 | 24.13 | 23.14 | 12.99 |
| PbO | 0.11 | 0.05 | 0.08 | 0.10 | 0.10 | 0.12 | 0.07 | 0.09 | 0.11 | 0.13 | 0.07 | 0.09 | 0.03 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.01 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.10 | 0.01 |
| Sc2O3 | 0.32 | 0.42 | 0.60 | 0.69 | 0.61 | 0.36 | 0.20 | 0.35 | 0.38 | 0.39 | 0.47 | 0.29 | 0.84 | 0.39 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Total | 98.99 | 99.56 | 99.47 | 98.76 | 98.96 | 98.99 | 99.64 | 99.82 | 99.57 | 99.64 | 99.68 | 99.78 | 99.00 | 98.48 |

**Structural formulae based on 32 oxygens**

| | NF | NG | NH | NU | NV | NJ | NN | NO | NP | NQ | NR | PA | PB | PC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.375 | 0.293 | 0.340 | 0.366 | 0.334 | 0.311 | 0.502 | 0.300 | 0.323 | 0.331 | 0.272 | 0.383 | 0.376 | 0.150 |
| Fe2+ | 2.188 | 2.290 | 2.213 | 2.218 | 2.262 | 2.142 | 1.909 | 2.216 | 2.167 | 2.197 | 2.266 | 1.994 | 2.089 | 2.361 |
| Mn | 1.426 | 1.412 | 1.439 | 1.406 | 1.394 | 1.535 | 1.582 | 1.475 | 1.499 | 1.459 | 1.454 | 1.614 | 1.531 | 1.482 |
| Fe3+ | 1.533 | 1.426 | 1.332 | 1.310 | 1.386 | 1.491 | 1.880 | 1.324 | 1.445 | 1.360 | 1.204 | 1.988 | 1.758 | 1.363 |
| Ti | 0.508 | 0.557 | 0.568 | 0.553 | 0.546 | 0.564 | 0.428 | 0.614 | 0.555 | 0.564 | 0.648 | 0.476 | 0.482 | 0.661 |
| Nb | 2.913 | 3.005 | 3.048 | 2.972 | 2.960 | 2.942 | 2.708 | 3.185 | 3.070 | 3.138 | 3.242 | 2.605 | 2.635 | 2.929 |
| Ta | 3.892 | 3.937 | 3.969 | 3.933 | 3.849 | 3.820 | 3.386 | 3.989 | 3.851 | 3.928 | 4.098 | 3.197 | 3.281 | 4.153 |
| Sn | 1.422 | 1.459 | 1.433 | 1.469 | 1.478 | 1.460 | 1.332 | 1.465 | 1.450 | 1.488 | 1.488 | 1.286 | 1.283 | 1.468 |
| W | 1.626 | 1.477 | 1.449 | 1.524 | 1.578 | 1.601 | 2.201 | 1.303 | 1.505 | 1.396 | 1.163 | 2.354 | 2.275 | 1.295 |
| Pb | 0.011 | 0.005 | 0.008 | 0.010 | 0.010 | 0.012 | 0.008 | 0.009 | 0.011 | 0.013 | 0.007 | 0.010 | 0.003 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.009 | 0.001 |
| Sc | 0.106 | 0.139 | 0.199 | 0.231 | 0.202 | 0.120 | 0.065 | 0.116 | 0.124 | 0.127 | 0.153 | 0.094 | 0.277 | 0.130 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

Comments: NF - NV same incl. NN - NR same incl.

all are inclusions in cassiterite

also contains microlite incls.

tungsteniferous ferrowodginite with complex zonation patterns

**Pegmatite 5**

96-AT23

| Raw data | PD1 | PD2 | PD3 | PD4 | PD5 | PD6 | PD7 | PD8 | PD9 | PD10 | PD11 | PD12 | PD13 | PD14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 13.03 | 13.18 | 12.45 | 12.45 | 12.46 | 12.46 | 12.40 | 12.51 | 12.46 | 12.48 | 12.48 | 12.53 | 12.56 | 12.51 |
| MnO | 4.66 | 4.78 | 4.16 | 4.18 | 4.07 | 4.03 | 4.02 | 4.05 | 3.96 | 4.00 | 3.99 | 4.04 | 4.01 | 4.01 |
| TiO2 | 1.59 | 1.59 | 2.34 | 2.25 | 2.22 | 2.20 | 2.29 | 2.29 | 2.29 | 2.28 | 2.27 | 2.29 | 2.26 | 2.26 |
| Nb2O5 | 14.94 | 14.80 | 18.12 | 18.11 | 17.97 | 18.23 | 18.12 | 18.10 | 18.16 | 18.07 | 18.44 | 18.24 | 18.20 | 18.02 |
| Ta2O5 | 31.18 | 30.76 | 38.75 | 38.58 | 38.33 | 38.39 | 38.37 | 38.30 | 38.50 | 38.57 | 38.35 | 38.39 | 38.52 | 38.44 |
| SnO2 | 8.45 | 8.52 | 10.06 | 10.03 | 10.12 | 10.06 | 10.10 | 10.10 | 9.90 | 10.03 | 10.16 | 10.12 | 9.98 | 10.06 |
| WO3 | 24.89 | 25.41 | 13.28 | 13.34 | 13.33 | 13.48 | 13.60 | 13.46 | 13.36 | 13.48 | 13.55 | 13.39 | 13.42 | 13.65 |
| PbO | 0.08 | 0.10 | 0.11 | 0.14 | 0.12 | 0.18 | 0.15 | 0.18 | 0.04 | 0.08 | 0.04 | 0.11 | 0.15 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.01 | 0.00 | 0.07 | 0.03 | 0.03 | 0.05 | 0.05 | 0.02 | 0.07 | 0.00 | 0.04 | 0.04 | 0.00 |
| Sc2O3 | 0.35 | 0.35 | 0.53 | 0.33 | 0.51 | 0.40 | 0.37 | 0.46 | 0.35 | 0.47 | 0.39 | 0.43 | 0.35 | 0.44 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| Total | 99.31 | 99.55 | 99.86 | 99.50 | 99.19 | 99.49 | 99.57 | 99.53 | 99.10 | 99.60 | 99.76 | 99.62 | 99.50 | 99.50 |

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| Recalculated oxides | PD1 | PD2 | PD3 | PD4 | PD5 | PD6 | PD7 | PD8 | PD9 | PD10 | PD11 | PD12 | PD13 | PD14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li2O | 0.27 | 0.25 | 0.06 | 0.08 | 0.06 | 0.09 | 0.10 | 0.07 | 0.11 | 0.09 | 0.11 | 0.08 | 0.09 | 0.09 |
| FeO | 6.56 | 6.56 | 8.13 | 7.96 | 8.13 | 8.04 | 8.00 | 8.13 | 8.05 | 8.14 | 8.10 | 8.15 | 8.08 | 8.11 |
| MnO | 4.66 | 4.78 | 4.16 | 4.18 | 4.07 | 4.03 | 4.02 | 4.05 | 3.96 | 4.00 | 3.99 | 4.04 | 4.01 | 4.01 |
| Fe2O3 | 6.98 | 7.14 | 4.68 | 4.88 | 4.70 | 4.80 | 4.76 | 4.74 | 4.78 | 4.70 | 4.74 | 4.75 | 4.86 | 4.77 |
| TiO2 | 1.59 | 1.59 | 2.34 | 2.25 | 2.22 | 2.20 | 2.29 | 2.29 | 2.29 | 2.28 | 2.27 | 2.29 | 2.26 | 2.26 |
| Nb2O5 | 14.94 | 14.80 | 18.12 | 18.11 | 17.97 | 18.23 | 18.12 | 18.10 | 18.16 | 18.07 | 18.44 | 18.24 | 18.20 | 18.02 |
| Ta2O5 | 31.18 | 30.76 | 38.75 | 38.58 | 38.33 | 38.39 | 38.37 | 38.30 | 38.50 | 38.57 | 38.35 | 38.39 | 38.52 | 38.44 |
| SnO2 | 8.45 | 8.52 | 10.06 | 10.03 | 10.12 | 10.06 | 10.10 | 10.10 | 9.90 | 10.03 | 10.16 | 10.12 | 9.98 | 10.06 |
| WO3 | 24.89 | 25.41 | 13.28 | 13.34 | 13.33 | 13.48 | 13.60 | 13.46 | 13.36 | 13.48 | 13.55 | 13.39 | 13.42 | 13.65 |
| PbO | 0.08 | 0.10 | 0.11 | 0.14 | 0.12 | 0.18 | 0.15 | 0.18 | 0.04 | 0.08 | 0.04 | 0.11 | 0.15 | 0.10 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.01 | 0.00 | 0.07 | 0.03 | 0.03 | 0.05 | 0.05 | 0.02 | 0.07 | 0.00 | 0.04 | 0.04 | 0.00 |
| Sc2O3 | 0.35 | 0.35 | 0.53 | 0.33 | 0.51 | 0.40 | 0.37 | 0.46 | 0.35 | 0.47 | 0.39 | 0.43 | 0.35 | 0.44 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.05 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 |
| Total | 99.99 | 100.26 | 100.22 | 99.94 | 99.59 | 99.93 | 99.96 | 99.93 | 99.50 | 99.99 | 100.18 | 100.02 | 99.94 | 99.94 |

**Structural formulae based on 32 oxygens**

| | PD1 | PD2 | PD3 | PD4 | PD5 | PD6 | PD7 | PD8 | PD9 | PD10 | PD11 | PD12 | PD13 | PD14 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.412 | 0.382 | 0.090 | 0.121 | 0.089 | 0.139 | 0.157 | 0.105 | 0.161 | 0.130 | 0.162 | 0.117 | 0.138 | 0.134 |
| Fe2+ | 2.095 | 2.089 | 2.576 | 2.531 | 2.593 | 2.555 | 2.544 | 2.585 | 2.567 | 2.586 | 2.565 | 2.585 | 2.568 | 2.577 |
| Mn | 1.485 | 1.519 | 1.323 | 1.334 | 1.305 | 1.288 | 1.283 | 1.291 | 1.268 | 1.275 | 1.269 | 1.288 | 1.280 | 1.279 |
| Fe3+ | 2.006 | 2.044 | 1.333 | 1.395 | 1.349 | 1.373 | 1.362 | 1.356 | 1.372 | 1.345 | 1.352 | 1.357 | 1.388 | 1.365 |
| Ti | 0.450 | 0.449 | 0.661 | 0.639 | 0.631 | 0.624 | 0.648 | 0.649 | 0.651 | 0.645 | 0.639 | 0.647 | 0.639 | 0.639 |
| Nb | 2.541 | 2.510 | 3.077 | 3.086 | 3.072 | 3.106 | 3.085 | 3.083 | 3.103 | 3.076 | 3.128 | 3.103 | 3.099 | 3.068 |
| Ta | 3.190 | 3.137 | 3.957 | 3.956 | 3.943 | 3.934 | 3.931 | 3.925 | 3.957 | 3.950 | 3.912 | 3.927 | 3.947 | 3.939 |
| Sn | 1.268 | 1.274 | 1.506 | 1.508 | 1.526 | 1.511 | 1.517 | 1.518 | 1.492 | 1.507 | 1.520 | 1.518 | 1.499 | 1.511 |
| W | 2.427 | 2.470 | 1.293 | 1.303 | 1.307 | 1.316 | 1.328 | 1.315 | 1.309 | 1.316 | 1.317 | 1.305 | 1.310 | 1.333 |
| Pb | 0.008 | 0.010 | 0.011 | 0.014 | 0.012 | 0.018 | 0.016 | 0.018 | 0.004 | 0.008 | 0.004 | 0.011 | 0.015 | 0.010 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.001 | 0.000 | 0.006 | 0.003 | 0.003 | 0.004 | 0.004 | 0.001 | 0.006 | 0.000 | 0.003 | 0.003 | 0.000 |
| Sc | 0.113 | 0.114 | 0.174 | 0.107 | 0.169 | 0.133 | 0.123 | 0.151 | 0.115 | 0.155 | 0.127 | 0.141 | 0.114 | 0.145 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.004 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | rim | | | | | | | | core | | | | | |

tungsteniferous ferrowodginite with complex zonation patterns

|  |  |  | Pegmatite 5 |  |  |  |  | East Beryl pegmatite |  |  |  | SW Beryl aplite |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | 96-AT23 |  |  |  |  | 97-1A |  |  |  | 97-69 |  |
| Raw data | PD15 | PD16 | PD17 | PD18 | PD19 | NB | NG1 | NG2 | NG3 | NG4 | NG5 | CA | CC |
| FeO | 12.45 | 12.47 | 12.57 | 12.51 | 13.16 | 0.30 | 0.36 | 0.36 | 0.36 | 0.37 | 0.34 | 10.29 | 10.59 |
| MnO | 4.00 | 4.07 | 4.09 | 3.99 | 4.55 | 10.39 | 10.96 | 10.89 | 10.94 | 11.01 | 10.95 | 2.47 | 2.43 |
| TiO2 | 2.22 | 2.21 | 2.19 | 2.31 | 1.63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.10 | 0.82 |
| Nb2O5 | 18.03 | 18.06 | 18.22 | 18.09 | 15.11 | 4.70 | 4.58 | 5.19 | 5.26 | 5.23 | 5.05 | 8.04 | 8.85 |
| Ta2O5 | 38.09 | 38.04 | 38.34 | 38.14 | 31.14 | 67.13 | 65.94 | 65.41 | 65.50 | 65.08 | 65.39 | 62.33 | 61.39 |
| SnO2 | 10.08 | 10.14 | 10.04 | 9.98 | 8.48 | 16.93 | 17.31 | 17.42 | 17.21 | 17.22 | 17.25 | 14.52 | 14.64 |
| WO3 | 13.57 | 13.72 | 13.78 | 13.57 | 24.43 | 0.19 | 0.20 | 0.29 | 0.35 | 0.33 | 0.23 | 0.10 | 0.24 |
| PbO | 0.15 | 0.10 | 0.14 | 0.14 | 0.12 | 0.06 | 0.01 | 0.06 | 0.03 | 0.00 | 0.00 | 0.04 | 0.01 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.52 | 0.28 | 0.49 | 0.37 | 0.29 | 0.10 | 0.04 | 0.18 | 0.00 | 0.00 | 0.01 | 0.13 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 |
| Total | 99.15 | 99.14 | 99.90 | 99.15 | 99.06 | 99.79 | 99.40 | 99.80 | 99.66 | 99.24 | 99.23 | 98.66 | 98.54 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Recalculated |  |  | 96-AT23 |  |  |  |  | 97-1A |  |  |  | 97-69 |  |
| oxides | PD15 | PD16 | PD17 | PD18 | PD19 | NB | NG1 | NG2 | NG3 | NG4 | NG5 | CA | CC |
| Li2O | 0.07 | 0.10 | 0.08 | 0.09 | 0.26 | 0.11 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.03 | 0.04 |
| FeO | 8.11 | 7.94 | 8.11 | 8.07 | 6.70 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 8.73 | 8.77 |
| MnO | 4.00 | 4.07 | 4.09 | 3.99 | 4.55 | 10.39 | 10.96 | 10.89 | 10.94 | 11.01 | 10.95 | 2.47 | 2.43 |
| Fe2O3 | 4.69 | 4.92 | 4.83 | 4.82 | 6.98 | 0.34 | 0.40 | 0.41 | 0.40 | 0.41 | 0.38 | 1.70 | 1.99 |
| TiO2 | 2.22 | 2.21 | 2.19 | 2.31 | 1.63 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.10 | 0.82 |
| Nb2O5 | 18.03 | 18.06 | 18.22 | 18.09 | 15.11 | 4.70 | 4.58 | 5.19 | 5.26 | 5.23 | 5.05 | 8.04 | 8.85 |
| Ta2O5 | 38.09 | 38.04 | 38.34 | 38.14 | 31.14 | 67.13 | 65.94 | 65.41 | 65.50 | 65.08 | 65.39 | 62.33 | 61.39 |
| SnO2 | 10.08 | 10.14 | 10.04 | 9.98 | 8.48 | 16.93 | 17.31 | 17.42 | 17.21 | 17.22 | 17.25 | 14.52 | 14.64 |
| WO3 | 13.57 | 13.72 | 13.78 | 13.57 | 24.43 | 0.19 | 0.20 | 0.29 | 0.35 | 0.33 | 0.23 | 0.10 | 0.24 |
| PbO | 0.15 | 0.10 | 0.14 | 0.14 | 0.12 | 0.06 | 0.01 | 0.06 | 0.03 | 0.00 | 0.00 | 0.04 | 0.01 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.52 | 0.28 | 0.49 | 0.37 | 0.29 | 0.10 | 0.04 | 0.18 | 0.00 | 0.00 | 0.01 | 0.13 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.03 | 0.00 |
| Total | 99.54 | 99.58 | 100.31 | 99.56 | 99.68 | 99.94 | 99.44 | 99.86 | 99.70 | 99.28 | 99.27 | 99.20 | 99.17 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.114 | 0.154 | 0.120 | 0.137 | 0.394 | 0.194 | 0.000 | 0.027 | 0.000 | 0.000 | 0.000 | 0.050 | 0.066 |
| Fe2+ | 2.589 | 2.532 | 2.567 | 2.571 | 2.142 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 3.070 | 3.074 |
| Mn | 1.283 | 1.304 | 1.299 | 1.278 | 1.452 | 3.800 | 4.029 | 3.966 | 3.997 | 4.036 | 4.019 | 0.877 | 0.859 |
| Fe3+ | 1.347 | 1.410 | 1.376 | 1.382 | 2.009 | 0.109 | 0.130 | 0.131 | 0.129 | 0.132 | 0.123 | 0.539 | 0.626 |
| Ti | 0.630 | 0.627 | 0.619 | 0.655 | 0.463 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.346 | 0.257 |
| Nb | 3.083 | 3.087 | 3.090 | 3.091 | 2.577 | 0.916 | 0.898 | 1.008 | 1.026 | 1.023 | 0.989 | 1.524 | 1.672 |
| Ta | 3.918 | 3.910 | 3.912 | 3.919 | 3.194 | 7.879 | 7.780 | 7.649 | 7.682 | 7.660 | 7.710 | 7.104 | 6.978 |
| Sn | 1.520 | 1.529 | 1.502 | 1.504 | 1.275 | 2.914 | 2.995 | 2.988 | 2.959 | 2.973 | 2.982 | 2.427 | 2.440 |
| W | 1.330 | 1.344 | 1.340 | 1.329 | 2.387 | 0.021 | 0.022 | 0.032 | 0.040 | 0.037 | 0.025 | 0.010 | 0.026 |
| Pb | 0.015 | 0.010 | 0.014 | 0.014 | 0.012 | 0.007 | 0.001 | 0.007 | 0.003 | 0.000 | 0.000 | 0.004 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.173 | 0.093 | 0.160 | 0.121 | 0.095 | 0.036 | 0.015 | 0.067 | 0.000 | 0.000 | 0.003 | 0.047 | 0.001 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.003 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 15.876 | 15.871 | 15.876 | 15.835 | 15.862 | 15.854 | 16.000 | 16.000 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: |  |  |  |  | rim |  |  | two inclusions in manganotantalite<br>structural formulae odd because of high Mn<br>from the 93-265 locality |  |  |  |  | all inclusions<br>in cassiterite |
|  |  |  | tungsteniferous ferrowodginite<br>with complex zonation patterns |  |  |  |  | all wodginite |  |  |  |  | ferrowodginite |

## Wodginite Group

|  | **SW Be aplite** |  |  |  |  |  | **Big Whopper pegmatite** |  |  |  |  | **Big Whopper** |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 97-69 |  |  |  |  |  | 97-BW7A |  |  |  |  | 97-BW7B |  |
| **Raw data** | CE | CF | GE | GF | GG | GQ | GA | GB | GD | GM | GO | JU | JV |
| FeO | 10.91 | 10.95 | 8.27 | 8.41 | 8.46 | 5.76 | 6.40 | 9.47 | 8.02 | 10.07 | 9.15 | 9.16 | 9.00 |
| MnO | 2.43 | 2.41 | 4.34 | 4.58 | 4.59 | 6.79 | 6.09 | 3.91 | 3.73 | 3.26 | 3.43 | 4.33 | 4.39 |
| TiO2 | 2.01 | 2.05 | 0.78 | 0.89 | 0.81 | 0.74 | 0.71 | 0.46 | 0.09 | 0.99 | 0.65 | 0.87 | 0.85 |
| Nb2O5 | 10.62 | 10.73 | 8.27 | 10.23 | 10.02 | 8.71 | 7.96 | 11.02 | 4.40 | 11.11 | 8.13 | 11.76 | 10.24 |
| Ta2O5 | 60.68 | 60.02 | 62.90 | 60.41 | 60.11 | 62.12 | 62.69 | 61.30 | 66.30 | 59.36 | 62.20 | 55.10 | 57.59 |
| SnO2 | 12.23 | 11.96 | 14.29 | 13.32 | 13.86 | 14.66 | 15.21 | 12.10 | 16.01 | 13.39 | 14.72 | 12.23 | 12.18 |
| WO3 | 0.38 | 0.39 | 0.43 | 0.50 | 0.47 | 0.31 | 0.39 | 0.40 | 0.14 | 0.51 | 0.37 | 3.92 | 3.32 |
| PbO | 0.02 | 0.03 | 0.05 | 0.01 | 0.03 | 0.04 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.21 | 0.19 | 0.00 | 0.08 | 0.05 | 0.00 | 0.18 | 0.10 | 0.00 | 0.06 | 0.01 | 0.16 | 0.07 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.05 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 | 0.00 |
| Total | 99.17 | 98.47 | 99.36 | 98.51 | 98.45 | 99.18 | 99.67 | 98.95 | 98.75 | 98.84 | 98.76 | 97.56 | 97.69 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Recalculated | 97-69 |  |  |  |  |  | 97-BW7A |  |  |  |  | 97-BW7B |  |
| oxides | CE | CF | GE | GF | GG | GQ | GA | GB | GD | GM | GO | JU | JV |
| Li2O | 0.03 | 0.03 | 0.11 | 0.08 | 0.06 | 0.10 | 0.07 | 0.10 | 0.12 | 0.06 | 0.08 | 0.14 | 0.13 |
| FeO | 9.07 | 9.06 | 6.49 | 6.44 | 6.51 | 4.06 | 4.92 | 7.05 | 6.62 | 8.01 | 7.43 | 6.53 | 6.39 |
| MnO | 2.43 | 2.41 | 4.34 | 4.58 | 4.59 | 6.79 | 6.09 | 3.91 | 3.73 | 3.26 | 3.43 | 4.33 | 4.39 |
| Fe2O3 | 1.99 | 2.04 | 1.94 | 2.14 | 2.13 | 1.86 | 1.62 | 2.63 | 1.51 | 2.25 | 1.86 | 2.84 | 2.83 |
| TiO2 | 2.01 | 2.05 | 0.78 | 0.89 | 0.81 | 0.74 | 0.71 | 0.46 | 0.09 | 0.99 | 0.65 | 0.87 | 0.85 |
| Nb2O5 | 10.62 | 10.73 | 8.27 | 10.23 | 10.02 | 8.71 | 7.96 | 11.02 | 4.40 | 11.11 | 8.13 | 11.76 | 10.24 |
| Ta2O5 | 60.68 | 60.02 | 62.90 | 60.41 | 60.11 | 62.12 | 62.69 | 61.30 | 66.30 | 59.36 | 62.20 | 55.10 | 57.59 |
| SnO2 | 12.23 | 11.96 | 14.29 | 13.32 | 13.86 | 14.66 | 15.21 | 12.10 | 16.01 | 13.39 | 14.72 | 12.23 | 12.18 |
| WO3 | 0.38 | 0.39 | 0.43 | 0.50 | 0.47 | 0.31 | 0.39 | 0.40 | 0.14 | 0.51 | 0.37 | 3.92 | 3.32 |
| PbO | 0.02 | 0.03 | 0.05 | 0.01 | 0.03 | 0.04 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.21 | 0.19 | 0.00 | 0.08 | 0.05 | 0.00 | 0.18 | 0.10 | 0.00 | 0.06 | 0.01 | 0.16 | 0.07 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.05 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 | 0.00 |
| Total | 99.67 | 98.90 | 99.58 | 98.73 | 98.66 | 99.39 | 99.84 | 99.20 | 98.91 | 98.99 | 98.91 | 97.89 | 97.99 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | **Structural formulae based on 32 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Li | 0.056 | 0.044 | 0.179 | 0.136 | 0.099 | 0.167 | 0.117 | 0.162 | 0.213 | 0.094 | 0.144 | 0.225 | 0.215 |
| Fe2+ | 3.102 | 3.117 | 2.278 | 2.251 | 2.279 | 1.425 | 1.727 | 2.452 | 2.416 | 2.770 | 2.632 | 2.265 | 2.239 |
| Mn | 0.839 | 0.837 | 1.537 | 1.612 | 1.619 | 2.404 | 2.156 | 1.371 | 1.371 | 1.136 | 1.225 | 1.509 | 1.547 |
| Fe3+ | 0.611 | 0.633 | 0.612 | 0.674 | 0.669 | 0.589 | 0.510 | 0.824 | 0.495 | 0.700 | 0.594 | 0.887 | 0.892 |
| Ti | 0.615 | 0.631 | 0.245 | 0.279 | 0.252 | 0.232 | 0.221 | 0.143 | 0.028 | 0.305 | 0.206 | 0.269 | 0.267 |
| Nb | 1.954 | 1.987 | 1.563 | 1.922 | 1.888 | 1.645 | 1.503 | 2.061 | 0.864 | 2.068 | 1.549 | 2.189 | 1.924 |
| Ta | 6.719 | 6.686 | 7.152 | 6.830 | 6.814 | 7.059 | 7.123 | 6.896 | 7.827 | 6.650 | 7.130 | 6.170 | 6.514 |
| Sn | 1.986 | 1.954 | 2.381 | 2.209 | 2.304 | 2.443 | 2.534 | 1.996 | 2.771 | 2.200 | 2.474 | 2.008 | 2.020 |
| W | 0.040 | 0.041 | 0.046 | 0.054 | 0.050 | 0.033 | 0.042 | 0.043 | 0.016 | 0.055 | 0.040 | 0.418 | 0.358 |
| Pb | 0.002 | 0.003 | 0.005 | 0.001 | 0.003 | 0.005 | 0.000 | 0.014 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.073 | 0.068 | 0.000 | 0.028 | 0.018 | 0.000 | 0.066 | 0.037 | 0.000 | 0.020 | 0.005 | 0.056 | 0.026 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.005 | 0.004 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: | CE & CF<br>same grain |  | from petalite part of section |  |  |  | five grains from albitite part of section |  |  |  |  | two tiny grains |  |
|  |  |  |  |  |  |  | mainly ferrowodginite |  |  |  |  |  | ferrowodginite |

| | GWN | | | | | | Pegmatite 7 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-GWN5 | | | | | | 97-P7-1 | | | | | | |
| Raw data | KN | SD | SE | SF | SG | SH | SI | SK | SL | SN | SQ | SR | SV |
| FeO | 6.13 | 10.04 | 9.76 | 9.91 | 10.21 | 10.15 | 9.91 | 10.27 | 10.03 | 10.09 | 10.15 | 10.05 | 10.03 |
| MnO | 6.94 | 3.74 | 3.86 | 3.63 | 3.54 | 3.44 | 3.72 | 3.51 | 3.71 | 3.66 | 3.60 | 3.76 | 3.70 |
| TiO2 | 1.16 | 2.63 | 2.07 | 2.45 | 2.55 | 1.94 | 2.04 | 3.31 | 3.24 | 3.18 | 2.90 | 3.01 | 2.31 |
| Nb2O5 | 9.98 | 13.98 | 12.85 | 13.23 | 14.49 | 12.53 | 13.40 | 13.86 | 13.17 | 13.76 | 13.77 | 14.45 | 14.17 |
| Ta2O5 | 58.27 | 54.59 | 55.49 | 55.96 | 54.50 | 56.25 | 53.53 | 55.00 | 55.07 | 55.05 | 54.77 | 54.18 | 54.02 |
| SnO2 | 13.25 | 11.73 | 11.83 | 11.44 | 11.79 | 12.49 | 12.09 | 11.25 | 11.34 | 10.81 | 11.42 | 11.17 | 11.97 |
| WO3 | 1.77 | 2.25 | 2.72 | 2.22 | 2.18 | 2.56 | 3.51 | 2.25 | 2.20 | 2.50 | 2.22 | 2.30 | 2.50 |
| PbO | 0.00 | 0.08 | 0.13 | 0.04 | 0.04 | 0.09 | 0.08 | 0.03 | 0.07 | 0.06 | 0.06 | 0.13 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.10 | 0.14 | 0.18 | 0.06 | 0.18 | 0.17 | 0.18 | 0.12 | 0.17 | 0.21 | 0.13 | 0.14 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 97.54 | 99.16 | 98.88 | 99.11 | 99.37 | 99.66 | 98.47 | 99.69 | 98.98 | 99.31 | 99.14 | 99.21 | 98.95 |

| Recalculated | 97-GWN5 | | | | | | 97-P7-1 | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| oxides | KN | SD | SE | SF | SG | SH | SI | SK | SL | SN | SQ | SR | SV |
| Li2O | 0.08 | 0.07 | 0.09 | 0.09 | 0.09 | 0.08 | 0.10 | 0.06 | 0.04 | 0.08 | 0.05 | 0.07 | 0.08 |
| FeO | 4.03 | 7.92 | 7.52 | 7.84 | 8.08 | 8.03 | 7.64 | 8.35 | 8.07 | 8.03 | 8.16 | 7.96 | 7.88 |
| MnO | 6.94 | 3.74 | 3.86 | 3.63 | 3.54 | 3.44 | 3.72 | 3.51 | 3.71 | 3.66 | 3.60 | 3.76 | 3.70 |
| Fe2O3 | 2.30 | 2.36 | 2.49 | 2.30 | 2.37 | 2.35 | 2.52 | 2.14 | 2.18 | 2.29 | 2.22 | 2.33 | 2.39 |
| TiO2 | 1.16 | 2.63 | 2.07 | 2.45 | 2.55 | 1.94 | 2.04 | 3.31 | 3.24 | 3.18 | 2.90 | 3.01 | 2.31 |
| Nb2O5 | 9.98 | 13.98 | 12.85 | 13.23 | 14.49 | 12.53 | 13.40 | 13.86 | 13.17 | 13.76 | 13.77 | 14.45 | 14.17 |
| Ta2O5 | 58.27 | 54.59 | 55.49 | 55.96 | 54.50 | 56.25 | 53.53 | 55.00 | 55.07 | 55.05 | 54.77 | 54.18 | 54.02 |
| SnO2 | 13.25 | 11.73 | 11.83 | 11.44 | 11.79 | 12.49 | 12.09 | 11.25 | 11.34 | 10.81 | 11.42 | 11.17 | 11.97 |
| WO3 | 1.77 | 2.25 | 2.72 | 2.22 | 2.18 | 2.56 | 3.51 | 2.25 | 2.20 | 2.50 | 2.22 | 2.30 | 2.50 |
| PbO | 0.00 | 0.08 | 0.13 | 0.04 | 0.04 | 0.09 | 0.08 | 0.03 | 0.07 | 0.06 | 0.06 | 0.13 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.03 | 0.10 | 0.14 | 0.18 | 0.06 | 0.18 | 0.17 | 0.18 | 0.12 | 0.17 | 0.21 | 0.13 | 0.14 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 97.82 | 99.44 | 99.19 | 99.40 | 99.67 | 99.93 | 98.79 | 99.93 | 99.21 | 99.58 | 99.38 | 99.47 | 99.23 |

**Structural formulae based on 32 oxygens**

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Li | 0.130 | 0.108 | 0.146 | 0.153 | 0.145 | 0.137 | 0.166 | 0.089 | 0.064 | 0.120 | 0.082 | 0.106 | 0.124 |
| Fe2+ | 1.414 | 2.628 | 2.528 | 2.617 | 2.668 | 2.689 | 2.563 | 2.742 | 2.679 | 2.650 | 2.703 | 2.624 | 2.621 |
| Mn | 2.455 | 1.256 | 1.312 | 1.226 | 1.183 | 1.165 | 1.263 | 1.166 | 1.250 | 1.224 | 1.209 | 1.257 | 1.247 |
| Fe3+ | 0.727 | 0.704 | 0.751 | 0.692 | 0.705 | 0.708 | 0.760 | 0.632 | 0.652 | 0.681 | 0.661 | 0.690 | 0.715 |
| Ti | 0.363 | 0.783 | 0.624 | 0.735 | 0.757 | 0.582 | 0.614 | 0.979 | 0.969 | 0.943 | 0.865 | 0.893 | 0.691 |
| Nb | 1.884 | 2.506 | 2.334 | 2.387 | 2.587 | 2.267 | 2.430 | 2.461 | 2.366 | 2.454 | 2.467 | 2.575 | 2.547 |
| Ta | 6.616 | 5.888 | 6.063 | 6.074 | 5.852 | 6.122 | 5.840 | 5.875 | 5.950 | 5.907 | 5.902 | 5.808 | 5.842 |
| Sn | 2.206 | 1.855 | 1.895 | 1.821 | 1.856 | 1.993 | 1.933 | 1.762 | 1.795 | 1.701 | 1.805 | 1.755 | 1.898 |
| W | 0.192 | 0.232 | 0.283 | 0.230 | 0.223 | 0.266 | 0.365 | 0.229 | 0.226 | 0.255 | 0.228 | 0.235 | 0.257 |
| Pb | 0.000 | 0.008 | 0.014 | 0.005 | 0.004 | 0.009 | 0.008 | 0.003 | 0.007 | 0.006 | 0.006 | 0.013 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Sc | 0.012 | 0.033 | 0.049 | 0.061 | 0.020 | 0.062 | 0.058 | 0.062 | 0.043 | 0.058 | 0.071 | 0.044 | 0.050 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |

| | | | | |
|---|---|---|---|---|
| Comments: | small<br>isolated<br>grain | SD - SH<br>same grain<br>partially mantled by cassiterite | incl. in<br>cass<br>assoc. SD etc | SK - SN<br>same grain<br>partially replaced<br>by ferrotantalite | SQ & SR<br>same grain |
| | wodginite | all are ferrowodginite - some closely associated with cassiterite | | | |

| | | | | **Pegmatite 10** | | | | | | **Pegmatite 10** | | **West pegmatite** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 97-P10-1 | | | | | | 97-P10-3 | | 97-WP2 | |
| Raw data | VA | VB | VG | VS | WD | JP | KB | KK | NG | NH | NM | CA | CB |
| FeO | 10.60 | 10.33 | 10.40 | 13.12 | 12.77 | 12.01 | 12.97 | 10.34 | 12.70 | 12.46 | 12.33 | 12.49 | 12.77 |
| MnO | 1.99 | 2.00 | 1.94 | 1.64 | 1.49 | 1.58 | 1.62 | 2.25 | 1.24 | 1.40 | 1.25 | 2.51 | 2.40 |
| TiO2 | 0.67 | 0.60 | 0.61 | 1.51 | 3.94 | 4.96 | 1.48 | 1.56 | 1.77 | 1.93 | 2.14 | 0.74 | 0.77 |
| Nb2O5 | 5.81 | 5.51 | 5.85 | 15.41 | 16.91 | 14.61 | 15.93 | 8.69 | 14.27 | 14.27 | 12.76 | 15.27 | 16.03 |
| Ta2O5 | 67.90 | 66.59 | 65.47 | 51.87 | 50.89 | 53.33 | 49.68 | 60.82 | 52.96 | 52.86 | 55.01 | 50.74 | 50.28 |
| SnO2 | 11.39 | 12.54 | 14.05 | 11.57 | 10.81 | 10.25 | 11.44 | 13.56 | 11.74 | 11.86 | 11.55 | 11.75 | 11.90 |
| WO3 | 0.06 | 0.12 | 0.25 | 3.01 | 1.68 | 0.81 | 4.29 | 0.57 | 2.48 | 2.60 | 2.09 | 4.41 | 4.32 |
| PbO | 0.00 | 0.00 | 0.11 | 0.08 | 0.00 | 0.05 | 0.08 | 0.00 | 0.10 | 0.09 | 0.01 | 0.05 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.08 | 0.00 | 0.07 | 0.21 | 0.06 | 0.27 | 0.19 | 0.13 | 0.24 | 0.22 | 0.17 | 0.10 | 0.04 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.52 | 97.74 | 98.80 | 98.47 | 98.56 | 97.87 | 97.66 | 97.94 | 97.49 | 97.69 | 97.30 | 98.06 | 98.57 |
| Recalculated | | | | 97-P10-1 | | | | | | 97-P10-3 | | 97-WP2 | |
| oxides | VA | VB | VG | VS | WD | JP | KB | KK | NG | NH | NM | CA | CB |
| Li2O | 0.14 | 0.13 | 0.10 | 0.00 | 0.01 | 0.00 | 0.06 | 0.07 | 0.04 | 0.05 | 0.06 | 0.04 | 0.04 |
| FeO | 8.41 | 8.35 | 8.67 | 10.27 | 10.76 | 10.63 | 10.05 | 8.80 | 10.32 | 10.15 | 10.15 | 9.15 | 9.37 |
| MnO | 1.99 | 2.00 | 1.94 | 1.64 | 1.49 | 1.58 | 1.62 | 2.25 | 1.24 | 1.40 | 1.25 | 2.51 | 2.40 |
| Fe2O3 | 2.35 | 2.14 | 1.86 | 3.10 | 2.20 | 1.51 | 3.24 | 1.71 | 2.60 | 2.52 | 2.37 | 3.65 | 3.72 |
| TiO2 | 0.67 | 0.60 | 0.61 | 1.51 | 3.94 | 4.96 | 1.48 | 1.56 | 1.77 | 1.93 | 2.14 | 0.74 | 0.77 |
| Nb2O5 | 5.81 | 5.51 | 5.85 | 15.41 | 16.91 | 14.61 | 15.93 | 8.69 | 14.27 | 14.27 | 12.76 | 15.27 | 16.03 |
| Ta2O5 | 67.90 | 66.59 | 65.47 | 51.87 | 50.89 | 53.33 | 49.68 | 60.82 | 52.96 | 52.86 | 55.01 | 50.74 | 50.28 |
| SnO2 | 11.39 | 12.54 | 14.05 | 11.57 | 10.81 | 10.25 | 11.44 | 13.56 | 11.74 | 11.86 | 11.55 | 11.75 | 11.90 |
| WO3 | 0.06 | 0.12 | 0.25 | 3.01 | 1.68 | 0.81 | 4.29 | 0.57 | 2.48 | 2.60 | 2.09 | 4.41 | 4.32 |
| PbO | 0.00 | 0.00 | 0.11 | 0.08 | 0.00 | 0.05 | 0.08 | 0.00 | 0.10 | 0.09 | 0.01 | 0.05 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.08 | 0.00 | 0.07 | 0.21 | 0.06 | 0.27 | 0.19 | 0.13 | 0.24 | 0.22 | 0.17 | 0.10 | 0.04 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 98.80 | 98.00 | 98.98 | 98.69 | 98.76 | 98.00 | 98.05 | 98.17 | 97.75 | 97.95 | 97.55 | 98.40 | 98.93 |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.241 | 0.226 | 0.164 | 0.002 | 0.010 | 0.000 | 0.092 | 0.112 | 0.064 | 0.080 | 0.093 | 0.061 | 0.058 |
| Fe2+ | 3.036 | 3.041 | 3.119 | 3.436 | 3.501 | 3.503 | 3.352 | 3.089 | 3.502 | 3.434 | 3.475 | 3.081 | 3.127 |
| Mn | 0.723 | 0.733 | 0.704 | 0.553 | 0.489 | 0.527 | 0.547 | 0.799 | 0.423 | 0.476 | 0.431 | 0.852 | 0.807 |
| Fe3+ | 0.762 | 0.702 | 0.601 | 0.933 | 0.645 | 0.447 | 0.973 | 0.540 | 0.793 | 0.766 | 0.729 | 1.107 | 1.117 |
| Ti | 0.217 | 0.194 | 0.197 | 0.453 | 1.150 | 1.466 | 0.443 | 0.493 | 0.537 | 0.585 | 0.657 | 0.222 | 0.229 |
| Nb | 1.126 | 1.079 | 1.132 | 2.774 | 2.968 | 2.599 | 2.871 | 1.648 | 2.609 | 2.600 | 2.352 | 2.768 | 2.879 |
| Ta | 7.913 | 7.843 | 7.619 | 5.617 | 5.374 | 5.705 | 5.386 | 6.939 | 5.824 | 5.793 | 6.101 | 5.532 | 5.432 |
| Sn | 1.946 | 2.165 | 2.398 | 1.837 | 1.673 | 1.607 | 1.819 | 2.268 | 1.893 | 1.906 | 1.878 | 1.879 | 1.885 |
| W | 0.007 | 0.014 | 0.028 | 0.311 | 0.169 | 0.082 | 0.444 | 0.062 | 0.260 | 0.271 | 0.221 | 0.458 | 0.445 |
| Pb | 0.000 | 0.000 | 0.013 | 0.009 | 0.000 | 0.006 | 0.008 | 0.000 | 0.011 | 0.010 | 0.001 | 0.005 | 0.007 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.029 | 0.000 | 0.025 | 0.074 | 0.020 | 0.093 | 0.064 | 0.047 | 0.085 | 0.078 | 0.061 | 0.034 | 0.012 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.036 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| Comments: | VA & VB<br>same grain<br>incl. in cass. | | incl. in<br>cass. | col./wodg<br>grain | col./wodg.<br>grain | | | KK & KL<br>same grain<br>incls. in cass | | inclusions in cassiterite | | CA & CB<br>same grain | |
| | cassiterite also contains inclusions of ferrotapiolite and microlite | | | | | | | | | | | | |
| | | | | all ferrowodginite | | | | | | all ferrowodginite | | ferrowodginite | |

| | **West pegmatite** | | | | | | | | **Big Mack pegmatite** | | | | **Whopper** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-WP2 | | | | | | | | 98-83Cii | | | | 98-SS29 |
| **Raw data** | CC | CH | SA | SC | SD | SH | SI | SJ | UB | UD | UE | UG | DM |
| FeO | 12.42 | 11.98 | 11.75 | 11.53 | 12.17 | 12.54 | 12.59 | 12.54 | 10.62 | 10.42 | 10.67 | 10.89 | 8.00 |
| MnO | 2.45 | 2.72 | 2.41 | 2.50 | 2.37 | 2.21 | 2.20 | 2.28 | 2.82 | 2.86 | 2.77 | 2.83 | 3.75 |
| TiO2 | 0.79 | 0.74 | 0.51 | 0.54 | 0.71 | 0.67 | 0.66 | 0.73 | 6.82 | 6.42 | 6.58 | 6.61 | 0.82 |
| Nb2O5 | 15.48 | 15.41 | 11.88 | 12.51 | 15.45 | 15.03 | 15.31 | 15.23 | 10.17 | 11.46 | 11.69 | 14.13 | 8.08 |
| Ta2O5 | 51.80 | 51.53 | 58.00 | 57.05 | 52.95 | 51.80 | 51.34 | 51.22 | 57.57 | 56.35 | 58.18 | 55.94 | 62.95 |
| SnO2 | 12.07 | 12.09 | 12.37 | 12.37 | 12.34 | 12.00 | 11.71 | 11.91 | 8.61 | 9.02 | 7.45 | 7.25 | 14.78 |
| WO3 | 3.30 | 3.22 | 2.21 | 1.47 | 2.69 | 3.94 | 4.31 | 4.47 | 2.33 | 1.94 | 0.94 | 0.79 | 0.32 |
| PbO | 0.05 | 0.10 | 0.14 | 0.04 | 0.05 | 0.14 | 0.06 | 0.07 | 0.27 | 0.10 | 0.04 | 0.12 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.12 | 0.17 | 0.02 | 0.16 | 0.07 | 0.02 | 0.06 | 0.40 | 0.30 | 0.48 | 0.37 | 0.10 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 |
| Total | 98.48 | 97.91 | 99.44 | 98.03 | 98.94 | 98.39 | 98.20 | 98.58 | 99.64 | 98.92 | 98.84 | 98.95 | 98.89 |
| | | | | | | | | | | | | | |
| **Recalculated** | 97-WP2 | | | | | | | | 98-83Cii | | | | 98-SS29 |
| **oxides** | CB | CH | SA | SC | SD | SH | SI | SJ | UB | UD | UE | UG | DM |
| Li2O | 0.02 | 0.03 | 0.05 | 0.05 | 0.05 | 0.06 | 0.08 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.18 |
| FeO | 9.32 | 8.92 | 8.99 | 8.81 | 9.29 | 9.31 | 9.24 | 9.24 | 9.49 | 9.32 | 9.53 | 9.57 | 6.72 |
| MnO | 2.45 | 2.72 | 2.41 | 2.50 | 2.37 | 2.21 | 2.20 | 2.28 | 2.82 | 2.86 | 2.77 | 2.83 | 3.75 |
| Fe2O3 | 3.38 | 3.34 | 3.01 | 2.98 | 3.13 | 3.51 | 3.65 | 3.59 | 1.25 | 1.23 | 1.27 | 1.47 | 1.42 |
| TiO2 | 0.79 | 0.74 | 0.51 | 0.54 | 0.71 | 0.67 | 0.66 | 0.73 | 6.82 | 6.42 | 6.58 | 6.61 | 0.82 |
| Nb2O5 | 15.48 | 15.41 | 11.88 | 12.51 | 15.45 | 15.03 | 15.31 | 15.23 | 10.17 | 11.46 | 11.69 | 14.13 | 8.08 |
| Ta2O5 | 51.80 | 51.53 | 58.00 | 57.05 | 52.95 | 51.80 | 51.34 | 51.22 | 57.57 | 56.35 | 58.18 | 55.94 | 62.95 |
| SnO2 | 12.07 | 12.09 | 12.37 | 12.37 | 12.34 | 12.00 | 11.71 | 11.91 | 8.61 | 9.02 | 7.45 | 7.25 | 14.78 |
| WO3 | 3.30 | 3.22 | 2.21 | 1.47 | 2.69 | 3.94 | 4.31 | 4.47 | 2.33 | 1.94 | 0.94 | 0.79 | 0.32 |
| PbO | 0.05 | 0.10 | 0.14 | 0.04 | 0.05 | 0.14 | 0.06 | 0.07 | 0.27 | 0.10 | 0.04 | 0.12 | 0.03 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.13 | 0.12 | 0.17 | 0.02 | 0.16 | 0.07 | 0.02 | 0.06 | 0.40 | 0.30 | 0.48 | 0.37 | 0.10 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 |
| Total | 98.79 | 98.22 | 99.73 | 98.33 | 99.24 | 98.73 | 98.58 | 98.94 | 99.74 | 98.98 | 98.95 | 99.08 | 99.20 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | | | | |
| Li | 0.036 | 0.046 | 0.075 | 0.080 | 0.077 | 0.092 | 0.134 | 0.116 | 0.000 | 0.000 | 0.000 | 0.000 | 0.298 |
| Fe2+ | 3.129 | 3.017 | 3.077 | 3.045 | 3.116 | 3.141 | 3.113 | 3.104 | 3.101 | 3.056 | 3.119 | 3.089 | 2.363 |
| Mn | 0.830 | 0.926 | 0.833 | 0.871 | 0.801 | 0.752 | 0.747 | 0.772 | 0.933 | 0.949 | 0.920 | 0.926 | 1.336 |
| Fe3+ | 1.022 | 1.014 | 0.927 | 0.925 | 0.946 | 1.066 | 1.106 | 1.083 | 0.369 | 0.362 | 0.374 | 0.426 | 0.451 |
| Ti | 0.238 | 0.224 | 0.157 | 0.167 | 0.213 | 0.202 | 0.200 | 0.219 | 2.005 | 1.893 | 1.937 | 1.919 | 0.258 |
| Nb | 2.797 | 2.804 | 2.187 | 2.328 | 2.788 | 2.726 | 2.774 | 2.749 | 1.796 | 2.031 | 2.069 | 2.465 | 1.537 |
| Ta | 5.632 | 5.639 | 6.426 | 6.385 | 5.749 | 5.653 | 5.595 | 5.563 | 6.116 | 6.008 | 6.195 | 5.872 | 7.200 |
| Sn | 1.924 | 1.939 | 2.010 | 2.030 | 1.965 | 1.920 | 1.871 | 1.897 | 1.341 | 1.409 | 1.163 | 1.116 | 2.478 |
| W | 0.342 | 0.336 | 0.233 | 0.157 | 0.278 | 0.409 | 0.448 | 0.462 | 0.236 | 0.197 | 0.095 | 0.079 | 0.035 |
| Pb | 0.005 | 0.011 | 0.015 | 0.004 | 0.005 | 0.015 | 0.006 | 0.008 | 0.028 | 0.010 | 0.004 | 0.012 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 |
| Sc | 0.045 | 0.042 | 0.060 | 0.008 | 0.055 | 0.023 | 0.007 | 0.019 | 0.135 | 0.101 | 0.165 | 0.124 | 0.036 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.006 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.062 | 16.015 | 16.043 | 16.028 | 16.000 |
| | | | | | | | | | | | | | |
| Comments: | | | | | | | | | associated & intergrown with struverite | | | | tiny |
| | | | | | | | | | some similarity with ixiolite | | | | grain |
| | | | | | | | | | may explain odd structural formulae | | | | assoc. |
| | | | | | | | | | | | | | microlite |
| | all ferrowodginite | | | | | | | | all ferrotitanowodginite | | | | Fe wodginite |

| | Glitter pegmatite | | | | | Glitter | Big Mack pegmatite | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 99-GZ5 | | | | | 99-GZ6 | EFR-6067A | | | |
| Raw data | BC | BD | BF | BI | BY | CD | FC | FD | FE | FF |
| FeO | 11.55 | 11.80 | 11.55 | 12.29 | 12.30 | 10.60 | 10.92 | 10.47 | 10.19 | 10.25 |
| MnO | 1.92 | 2.05 | 1.97 | 1.96 | 2.20 | 2.35 | 3.53 | 3.54 | 3.59 | 3.60 |
| TiO2 | 0.37 | 0.44 | 0.37 | 0.51 | 0.69 | 1.23 | 1.71 | 1.90 | 1.77 | 1.65 |
| Nb2O5 | 11.79 | 13.66 | 12.20 | 15.80 | 16.76 | 8.96 | 14.32 | 14.45 | 14.00 | 13.50 |
| Ta2O5 | 59.58 | 58.14 | 59.29 | 55.00 | 56.64 | 61.91 | 50.23 | 50.18 | 52.96 | 53.54 |
| SnO2 | 13.94 | 13.77 | 13.69 | 13.10 | 10.51 | 13.63 | 11.25 | 10.94 | 11.63 | 11.52 |
| WO3 | 0.11 | 0.12 | 0.11 | 0.12 | 0.25 | 0.04 | 5.23 | 4.64 | 3.08 | 2.81 |
| PbO | 0.07 | 0.11 | 0.05 | 0.04 | 0.10 | 0.01 | 0.02 | 0.11 | 0.04 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.12 | 0.08 | 0.15 | 0.08 | 0.09 | 0.09 | 0.12 | 0.35 | 0.15 | 0.35 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.49 | 100.21 | 99.42 | 98.96 | 99.55 | 98.86 | 97.34 | 96.58 | 97.41 | 97.36 |
| | | | | | | | | | | |
| Recalculated | 99-GZ5 | | | | | 99-GZ6 | EFR-6067A | | | |
| oxides | BC | BD | BF | BI | BY | CD | FC | FD | FE | FF |
| Li2O | 0.06 | 0.06 | 0.07 | 0.03 | 0.10 | 0.05 | 0.08 | 0.07 | 0.09 | 0.04 |
| FeO | 9.35 | 9.45 | 9.30 | 9.74 | 9.27 | 8.80 | 7.95 | 7.86 | 7.76 | 7.90 |
| MnO | 1.92 | 2.05 | 1.97 | 1.96 | 2.20 | 2.35 | 3.53 | 3.54 | 3.59 | 3.60 |
| Fe2O3 | 2.40 | 2.55 | 2.46 | 2.78 | 3.29 | 1.97 | 3.31 | 2.90 | 2.70 | 2.62 |
| TiO2 | 0.37 | 0.44 | 0.37 | 0.51 | 0.69 | 1.23 | 1.71 | 1.90 | 1.77 | 1.65 |
| Nb2O5 | 11.79 | 13.66 | 12.20 | 15.80 | 16.76 | 8.96 | 14.32 | 14.45 | 14.00 | 13.50 |
| Ta2O5 | 59.58 | 58.14 | 59.29 | 55.00 | 56.64 | 61.91 | 50.23 | 50.18 | 52.96 | 53.54 |
| SnO2 | 13.94 | 13.77 | 13.69 | 13.10 | 10.51 | 13.63 | 11.25 | 10.94 | 11.63 | 11.52 |
| WO3 | 0.11 | 0.12 | 0.11 | 0.12 | 0.25 | 0.04 | 5.23 | 4.64 | 3.08 | 2.81 |
| PbO | 0.07 | 0.11 | 0.05 | 0.04 | 0.10 | 0.01 | 0.02 | 0.11 | 0.04 | 0.13 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.12 | 0.08 | 0.15 | 0.08 | 0.09 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.35 | 0.15 | 0.35 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.72 | 100.43 | 99.65 | 99.21 | 99.89 | 99.03 | 97.75 | 96.95 | 97.77 | 97.66 |
| | | | | | | | | | | |
| | **Structural formulae based on 32 oxygens** | | | | | | | | | |
| Li | 0.104 | 0.093 | 0.114 | 0.046 | 0.160 | 0.090 | 0.124 | 0.117 | 0.140 | 0.059 |
| Fe2+ | 3.220 | 3.197 | 3.198 | 3.284 | 3.092 | 3.079 | 2.671 | 2.659 | 2.626 | 2.686 |
| Mn | 0.669 | 0.698 | 0.682 | 0.666 | 0.738 | 0.829 | 1.203 | 1.212 | 1.229 | 1.241 |
| Fe3+ | 0.744 | 0.777 | 0.761 | 0.844 | 0.987 | 0.621 | 1.000 | 0.884 | 0.823 | 0.802 |
| Ti | 0.115 | 0.134 | 0.113 | 0.154 | 0.204 | 0.385 | 0.517 | 0.578 | 0.538 | 0.506 |
| Nb | 2.188 | 2.487 | 2.260 | 2.870 | 3.005 | 1.691 | 2.603 | 2.644 | 2.560 | 2.482 |
| Ta | 6.650 | 6.369 | 6.605 | 6.008 | 6.109 | 7.023 | 5.490 | 5.521 | 5.827 | 5.922 |
| Sn | 2.281 | 2.212 | 2.236 | 2.098 | 1.662 | 2.268 | 1.803 | 1.765 | 1.877 | 1.868 |
| W | 0.011 | 0.013 | 0.012 | 0.012 | 0.025 | 0.004 | 0.545 | 0.487 | 0.322 | 0.297 |
| Pb | 0.007 | 0.012 | 0.006 | 0.004 | 0.010 | 0.001 | 0.002 | 0.012 | 0.005 | 0.014 |
| Th | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.011 | 0.007 | 0.014 | 0.007 | 0.008 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.042 | 0.122 | 0.054 | 0.125 |
| Sb | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 | 16.000 |
| | | | | | | | | | | |
| Comments: | BC - BF inclusions in same cassiterite | | | incl. in cass. | incl. in cass. | inclusion in cassiterite | FC mantles col. | FD - FF same grain<br>Emerald Fields Resource Corporation sample<br>all ferrowodginite | | |

# Ferrotapiolite

|  | **Peg. 5** | **SW Beryl pegmatite** |  |  |  |  |  |  |  |  |  |  |  | **SW Be peg.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-80P | 96-9 |  |  |  |  |  |  |  |  |  |  |  | 96-11A |
|  | MH | GC | GD | GE | FD | FE | FI | FJ | GD2 | FQ | FR | FS | FT | PI |
| FeO | 13.24 | 15.08 | 15.00 | 14.85 | 14.48 | 14.03 | 14.11 | 14.08 | 14.04 | 14.28 | 14.72 | 14.44 | 14.29 | 13.86 |
| MnO | 1.07 | 0.02 | 0.01 | 0.00 | 0.02 | 0.02 | 0.13 | 0.17 | 0.20 | 0.05 | 0.04 | 0.03 | 0.03 | 0.36 |
| TiO2 | 0.92 | 3.60 | 3.31 | 3.45 | 3.40 | 3.29 | 3.65 | 3.90 | 2.53 | 4.32 | 4.18 | 2.98 | 3.54 | 0.86 |
| Nb2O5 | 3.54 | 10.61 | 10.34 | 10.24 | 9.60 | 6.81 | 8.25 | 8.17 | 6.64 | 9.10 | 9.17 | 6.38 | 7.14 | 3.41 |
| Ta2O5 | 80.16 | 69.39 | 69.38 | 69.85 | 70.83 | 74.06 | 71.10 | 71.23 | 75.58 | 70.79 | 70.69 | 74.77 | 74.31 | 80.08 |
| SnO2 | 1.28 | 0.53 | 0.56 | 0.48 | 0.54 | 0.55 | 2.19 | 1.31 | 1.59 | 1.63 | 1.10 | 1.31 | 1.11 | 1.08 |
| WO3 | 0.00 | 0.38 | 0.36 | 0.33 | 0.36 | 0.27 | 0.34 | 0.25 | 0.24 | 0.41 | 0.31 | 0.22 | 0.33 | 0.61 |
| PbO | 0.55 | 0.09 | 0.06 | 0.00 | 0.00 | 0.02 | 0.04 | 0.02 | 0.06 | 0.04 | 0.02 | 0.03 | 0.00 | 0.01 |
| ThO2 | 0.00 | 0.02 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.05 | 0.02 | 0.09 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.03 | 0.00 | 0.00 | 0.06 | 0.01 | 0.00 | 0.02 | 0.02 | 0.04 | 0.01 | 0.00 | 0.01 | 0.06 |
| Sc2O3 | 0.07 | 0.15 | 0.11 | 0.07 | 0.08 | 0.07 | 0.00 | 0.05 | 0.00 | 0.05 | 0.16 | 0.01 | 0.15 | 0.17 |
| CaO |  | 0.03 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.10 |
| Total | 100.82 | 99.87 | 99.20 | 99.26 | 99.41 | 99.11 | 99.80 | 99.25 | 100.91 | 100.88 | 100.43 | 100.16 | 100.91 | 100.58 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.909 | 0.968 | 0.973 | 0.963 | 0.942 | 0.933 | 0.919 | 0.920 | 0.926 | 0.911 | 0.942 | 0.955 | 0.928 | 0.950 |
| Mn | 0.074 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.008 | 0.011 | 0.013 | 0.003 | 0.003 | 0.002 | 0.002 | 0.025 |
| Ti | 0.057 | 0.208 | 0.193 | 0.201 | 0.199 | 0.197 | 0.214 | 0.229 | 0.150 | 0.248 | 0.241 | 0.177 | 0.207 | 0.053 |
| Nb | 0.131 | 0.368 | 0.363 | 0.359 | 0.338 | 0.245 | 0.290 | 0.289 | 0.237 | 0.314 | 0.317 | 0.228 | 0.251 | 0.126 |
| Ta | 1.789 | 1.448 | 1.464 | 1.473 | 1.499 | 1.601 | 1.505 | 1.513 | 1.621 | 1.468 | 1.471 | 1.608 | 1.570 | 1.786 |
| Sn | 0.042 | 0.016 | 0.017 | 0.015 | 0.017 | 0.017 | 0.068 | 0.041 | 0.050 | 0.050 | 0.034 | 0.041 | 0.034 | 0.035 |
| W | 0.000 | 0.008 | 0.007 | 0.007 | 0.007 | 0.005 | 0.007 | 0.005 | 0.005 | 0.008 | 0.006 | 0.005 | 0.007 | 0.013 |
| Pb | 0.012 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.005 | 0.010 | 0.007 | 0.005 | 0.005 | 0.005 | 0.000 | 0.003 | 0.000 | 0.004 | 0.010 | 0.001 | 0.010 | 0.012 |
| Ca |  | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.008 |
| Total | 3.019 | 3.032 | 3.029 | 3.022 | 3.012 | 3.004 | 3.012 | 3.014 | 3.003 | 3.010 | 3.025 | 3.018 | 3.009 | 3.011 |
| Mn/(Mn+Fe) | 0.075 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.009 | 0.012 | 0.014 | 0.004 | 0.003 | 0.002 | 0.002 | 0.026 |
| Ta/(Ta+Nb) | 0.932 | 0.797 | 0.801 | 0.804 | 0.816 | 0.867 | 0.838 | 0.840 | 0.873 | 0.824 | 0.823 | 0.876 | 0.862 | 0.934 |
| Comments: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  | assoc. with wodginite | GC - FD ferrotapiolite rim on ferrotantalite - see FA, GA & GB |  |  |  |  | FI, FJ & GD2 same grain |  |  |  |  |  |  | incl. in cass. PJ |
|  |  |  |  |  |  |  |  | not associated with ferrotantalite |  |  |  |  |  |  |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

| | SW Beryl peg. | | Sep. Rapids pluton | | | | | | SW Beryl pegmatite | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96053A | | 96-72A | | | | | | 96-81 | | | | | | | |
| | SA | SB | AI | AJ | AN | AO | AS | AT | NE | NF | NG | NH | NI | NJ | NK | NL |
| FeO | 14.38 | 14.53 | 13.93 | 13.90 | 13.76 | 13.63 | 13.86 | 13.89 | 13.63 | 13.95 | 13.68 | 13.76 | 13.43 | 13.74 | 13.81 | 13.46 |
| MnO | 0.09 | 0.09 | 0.74 | 0.74 | 0.75 | 0.85 | 0.82 | 0.81 | 0.45 | 0.30 | 0.28 | 0.25 | 0.43 | 0.29 | 0.36 | 0.25 |
| TiO2 | 0.69 | 0.69 | 1.02 | 0.95 | 1.16 | 0.81 | 0.54 | 0.84 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 |
| Nb2O5 | 8.22 | 8.22 | 7.72 | 6.92 | 6.23 | 6.29 | 4.64 | 6.77 | 4.12 | 5.60 | 4.08 | 5.50 | 3.59 | 4.14 | 4.86 | 3.64 |
| Ta2O5 | 74.61 | 74.61 | 75.59 | 76.47 | 77.51 | 77.65 | 80.03 | 77.43 | 81.20 | 79.16 | 80.87 | 79.84 | 81.66 | 79.52 | 78.97 | 82.14 |
| SnO2 | 0.99 | 0.87 | 1.14 | 1.02 | 1.04 | 0.98 | 0.75 | 0.89 | 0.62 | 1.13 | 0.97 | 0.86 | 0.57 | 1.63 | 1.10 | 0.29 |
| WO3 | 0.22 | 0.19 | 0.25 | 0.26 | 0.37 | 0.25 | 0.28 | 0.26 | 0.33 | 0.56 | 0.22 | 0.19 | 0.14 | 0.23 | 0.45 | 0.00 |
| PbO | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.40 | 0.70 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.63 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.02 | 0.00 | 0.00 | 0.12 | 0.16 | 0.00 | 0.18 | 0.40 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.06 | 0.03 | 0.00 | 0.45 | 0.00 | 0.28 | 0.29 | 0.00 |
| Sc2O3 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.72 | 0.00 | 0.00 | 0.01 | 0.01 | 0.15 |
| CaO | 0.00 | 0.00 | | | | | | | | | | | | | | |
| Total | 99.23 | 99.20 | 100.39 | 100.31 | 100.88 | 100.49 | 100.93 | 100.91 | 100.42 | 100.82 | 100.94 | 101.02 | 100.33 | 100.84 | 100.88 | 99.93 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.973 | 0.984 | 0.931 | 0.936 | 0.924 | 0.921 | 0.945 | 0.932 | 0.945 | 0.952 | 0.938 | 0.942 | 0.936 | 0.952 | 0.951 | 0.940 |
| Mn | 0.006 | 0.006 | 0.050 | 0.051 | 0.051 | 0.058 | 0.057 | 0.055 | 0.032 | 0.021 | 0.020 | 0.017 | 0.030 | 0.020 | 0.025 | 0.018 |
| Ti | 0.042 | 0.042 | 0.061 | 0.058 | 0.070 | 0.049 | 0.033 | 0.050 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 | 0.000 | 0.000 | 0.000 |
| Nb | 0.301 | 0.301 | 0.279 | 0.252 | 0.226 | 0.230 | 0.171 | 0.246 | 0.154 | 0.207 | 0.151 | 0.203 | 0.135 | 0.155 | 0.181 | 0.137 |
| Ta | 1.642 | 1.643 | 1.644 | 1.675 | 1.691 | 1.707 | 1.775 | 1.689 | 1.829 | 1.758 | 1.802 | 1.777 | 1.851 | 1.792 | 1.769 | 1.865 |
| Sn | 0.032 | 0.028 | 0.036 | 0.033 | 0.033 | 0.032 | 0.024 | 0.028 | 0.021 | 0.037 | 0.032 | 0.028 | 0.019 | 0.054 | 0.036 | 0.010 |
| W | 0.005 | 0.004 | 0.005 | 0.005 | 0.008 | 0.005 | 0.006 | 0.005 | 0.007 | 0.012 | 0.005 | 0.004 | 0.003 | 0.005 | 0.010 | 0.000 |
| Pb | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.009 | 0.016 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.012 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.003 | 0.000 | 0.003 | 0.007 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.009 | 0.000 | 0.006 | 0.006 | 0.000 |
| Sc | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.052 | 0.000 | 0.000 | 0.001 | 0.001 | 0.011 |
| Ca | 0.000 | 0.000 | | | | | | | | | | | | | | |
| Total | 3.002 | 3.007 | 3.007 | 3.009 | 3.004 | 3.003 | 3.012 | 3.007 | 2.989 | 2.990 | 3.001 | 2.985 | 2.990 | 3.006 | 2.998 | 2.981 |
| Mn/(Mn+Fe) | 0.006 | 0.006 | 0.051 | 0.051 | 0.052 | 0.060 | 0.056 | 0.056 | 0.033 | 0.021 | 0.021 | 0.018 | 0.032 | 0.021 | 0.026 | 0.019 |
| Ta/(Ta+Nb) | 0.845 | 0.845 | 0.855 | 0.869 | 0.882 | 0.881 | 0.912 | 0.873 | 0.922 | 0.895 | 0.923 | 0.897 | 0.932 | 0.920 | 0.907 | 0.931 |
| Comments: | | | | | | | | | | | | | | | | |
| | SA & SB same grain incl. in cass.; assoc. with ferro- tantalite | | | AI - AT same grain | | | AI - AT same grain | | | NE - NH | | | | | NJ - NL | |
| | | | | assoc. with ferrowodginite | | assoc. with ferro-wod-ginite | | | | same cluster | | | | | same grain | |

all data from ferrotantalite - ferrotapiolite clusters (ferrotantalite earlier)

## Ferrotapiolite

**SW Beryl pegmatite**
**96-81**

| | NI2 | NJ2 | NK2 | NL2 | NN | NO | NP | NQ | NU | NV | GA | GB | GE | GG | GI | GJ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **FeO** | 13.95 | 13.95 | 13.81 | 13.91 | 13.73 | 14.29 | 14.08 | 14.11 | 13.88 | 13.57 | 14.06 | 13.88 | 14.06 | 13.89 | 13.90 | 13.83 |
| MnO | 0.29 | 0.37 | 0.36 | 0.36 | 0.36 | 0.24 | 0.30 | 0.45 | 0.27 | 0.24 | 0.35 | 0.33 | 0.15 | 0.26 | 0.34 | 0.43 |
| TiO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.07 | 0.00 | 0.00 | 0.26 | 0.25 | 0.94 | 3.35 | 0.95 | 0.85 |
| Nb2O5 | 8.00 | 7.92 | 4.86 | 6.89 | 6.00 | 8.15 | 7.16 | 6.58 | 6.26 | 4.72 | 6.04 | 6.29 | 7.20 | 7.31 | 5.11 | 4.95 |
| Ta2O5 | 76.09 | 77.01 | 78.97 | 77.55 | 78.31 | 77.04 | 77.86 | 77.72 | 78.42 | 79.02 | 78.71 | 77.40 | 76.76 | 73.81 | 78.85 | 78.23 |
| SnO2 | 0.89 | 0.58 | 1.10 | 0.71 | 0.98 | 0.27 | 0.48 | 0.61 | 1.04 | 1.12 | 0.38 | 0.74 | 0.48 | 1.06 | 0.51 | 0.45 |
| WO3 | 0.32 | 0.30 | 0.45 | 0.37 | 0.26 | 0.49 | 0.20 | 0.25 | 0.36 | 0.09 | 0.63 | 0.29 | 0.28 | 0.36 | 0.30 | 0.26 |
| PbO | 0.00 | 0.00 | 0.00 | 0.01 | 0.64 | 0.07 | 0.27 | 0.24 | 0.00 | 0.62 | 0.00 | 0.09 | 0.00 | 0.02 | 0.00 | 0.05 |
| ThO2 | 0.03 | 0.01 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.24 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.22 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.30 | 0.00 | 0.17 | 0.00 | 0.20 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.08 | 0.00 | 0.50 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 |
| Sc2O3 | 0.08 | 0.00 | 0.00 | 0.00 | 0.41 | 0.00 | 0.05 | 0.00 | 0.00 | 0.06 | 0.01 | 0.00 | 0.00 | 0.07 | 0.03 | 0.00 |
| CaO | | | | | | | | | | | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Total | 99.66 | 100.17 | 99.64 | 99.80 | 100.69 | 100.91 | 100.64 | 100.69 | 100.46 | 99.65 | 100.46 | 99.27 | 99.91 | 100.13 | 99.98 | 99.06 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Fe | 0.949 | 0.946 | 0.958 | 0.952 | 0.937 | 0.962 | 0.957 | 0.962 | 0.948 | 0.947 | 0.958 | 0.956 | 0.950 | 0.911 | 0.950 | 0.956 |
| Mn | 0.020 | 0.025 | 0.025 | 0.025 | 0.025 | 0.016 | 0.021 | 0.031 | 0.019 | 0.017 | 0.024 | 0.023 | 0.010 | 0.017 | 0.023 | 0.030 |
| Ti | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.004 | 0.000 | 0.000 | 0.016 | 0.016 | 0.057 | 0.198 | 0.058 | 0.053 |
| Nb | 0.294 | 0.290 | 0.182 | 0.255 | 0.221 | 0.296 | 0.263 | 0.243 | 0.231 | 0.178 | 0.223 | 0.234 | 0.263 | 0.259 | 0.189 | 0.185 |
| Ta | 1.683 | 1.698 | 1.782 | 1.726 | 1.738 | 1.686 | 1.720 | 1.723 | 1.742 | 1.792 | 1.745 | 1.734 | 1.687 | 1.574 | 1.753 | 1.759 |
| Sn | 0.029 | 0.019 | 0.036 | 0.023 | 0.032 | 0.009 | 0.015 | 0.020 | 0.034 | 0.037 | 0.012 | 0.024 | 0.015 | 0.033 | 0.017 | 0.015 |
| W | 0.007 | 0.006 | 0.010 | 0.008 | 0.005 | 0.010 | 0.004 | 0.005 | 0.008 | 0.002 | 0.013 | 0.006 | 0.006 | 0.007 | 0.006 | 0.006 |
| Pb | 0.000 | 0.000 | 0.000 | 0.000 | 0.014 | 0.001 | 0.006 | 0.005 | 0.000 | 0.014 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 |
| Th | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 | 0.000 | 0.006 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.010 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.006 | 0.000 | 0.000 | 0.000 | 0.029 | 0.000 | 0.003 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.000 | 0.005 | 0.002 | 0.000 |
| Ca | | | | | | | | | | | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 2.988 | 2.985 | 2.996 | 2.989 | 3.003 | 2.992 | 2.995 | 3.009 | 2.986 | 2.998 | 2.994 | 2.995 | 2.990 | 3.004 | 2.999 | 3.005 |
| Mn/(Mn+Fe) | 0.021 | 0.026 | 0.026 | 0.026 | 0.026 | 0.017 | 0.021 | 0.031 | 0.020 | 0.018 | 0.025 | 0.024 | 0.011 | 0.019 | 0.024 | 0.031 |
| Ta/(Ta+Nb) | 0.851 | 0.854 | 0.907 | 0.871 | 0.887 | 0.851 | 0.867 | 0.877 | 0.883 | 0.910 | 0.887 | 0.881 | 0.865 | 0.859 | 0.903 | 0.905 |

Comments:

NN - NP same grain

NU & NV same grain

GI & GJ same grain

all data from ferrotantalite - ferrotapiolite clusters (ferrotantalite earlier)

## Ferrotapiolite

| | SW Be peg. 96-81X | SW Be peg. 97-69 | School of Fish pegmatite 97-71 | | | | | | | | Pegmatite 10 97-P10-1 | | | | Peg. 10 97-P10-4 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | GD | CB | HL | HM | HN | FP | FQ | FR | FS | FT | KJ | VD | VE | VF | EI |
| FeO | 14.36 | 13.83 | 13.33 | 13.29 | 13.33 | 13.95 | 13.55 | 12.86 | 13.41 | 13.20 | 13.98 | 14.01 | 11.36 | 14.28 | 13.47 |
| MnO | 0.28 | 0.58 | 0.14 | 0.13 | 0.15 | 0.28 | 0.55 | 0.44 | 0.42 | 0.43 | 0.31 | 0.08 | 0.06 | 0.15 | 0.13 |
| TiO2 | 0.19 | 1.55 | 5.12 | 5.26 | 5.86 | 4.23 | 4.09 | 6.26 | 4.60 | 4.50 | 1.72 | 4.02 | 2.00 | 1.60 | 1.54 |
| Nb2O5 | 5.18 | 5.92 | 7.09 | 6.96 | 6.95 | 8.01 | 8.57 | 8.18 | 6.91 | 7.05 | 6.82 | 7.40 | 6.28 | 5.89 | 6.65 |
| Ta2O5 | 78.69 | 77.13 | 71.09 | 71.04 | 71.11 | 70.64 | 69.47 | 69.42 | 72.14 | 72.17 | 75.91 | 70.79 | 73.75 | 76.03 | 74.33 |
| SnO2 | 1.13 | 0.56 | 2.20 | 2.33 | 1.88 | 2.27 | 2.91 | 2.06 | 1.81 | 1.75 | 1.18 | 2.91 | 1.89 | 1.10 | 2.93 |
| WO3 | 0.27 | 0.31 | 0.31 | 0.28 | 0.25 | 0.35 | 0.33 | 0.29 | 0.29 | 0.23 | 0.36 | 0.46 | 0.37 | 0.36 | 0.24 |
| PbO | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.03 | 0.00 | 0.03 | 0.00 | 0.04 | 0.00 | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.06 | 0.05 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.04 | 0.01 | 0.03 | 0.03 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 | 0.03 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.10 | 0.20 | 0.20 | 0.36 | 0.13 | 0.12 | 0.35 | 0.15 | 0.20 | 0.03 | 0.07 | 0.01 | 0.02 | 0.00 |
| CaO | 0.02 | 0.03 | 0.00 | 0.02 | 0.01 | 0.00 | 0.00 | 0.09 | 0.02 | 0.04 | 0.01 | 0.00 | 2.77 | 0.00 | 0.01 |
| Total | 100.18 | 100.05 | 99.49 | 99.59 | 99.93 | 99.91 | 99.65 | 100.00 | 99.77 | 99.62 | 100.39 | 99.74 | 98.66 | 99.48 | 99.34 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.985 | 0.933 | 0.862 | 0.858 | 0.852 | 0.902 | 0.876 | 0.812 | 0.871 | 0.859 | 0.933 | 0.912 | 0.763 | 0.968 | 0.910 |
| Mn | 0.019 | 0.039 | 0.009 | 0.009 | 0.010 | 0.018 | 0.036 | 0.028 | 0.028 | 0.028 | 0.021 | 0.005 | 0.004 | 0.010 | 0.009 |
| Ti | 0.012 | 0.094 | 0.298 | 0.305 | 0.337 | 0.246 | 0.238 | 0.356 | 0.268 | 0.263 | 0.103 | 0.235 | 0.121 | 0.097 | 0.093 |
| Nb | 0.192 | 0.216 | 0.248 | 0.243 | 0.240 | 0.280 | 0.300 | 0.279 | 0.243 | 0.248 | 0.246 | 0.260 | 0.228 | 0.216 | 0.243 |
| Ta | 1.756 | 1.692 | 1.495 | 1.492 | 1.478 | 1.485 | 1.460 | 1.426 | 1.524 | 1.527 | 1.648 | 1.499 | 1.612 | 1.676 | 1.633 |
| Sn | 0.037 | 0.018 | 0.068 | 0.072 | 0.057 | 0.070 | 0.090 | 0.062 | 0.056 | 0.054 | 0.037 | 0.090 | 0.061 | 0.036 | 0.094 |
| W | 0.006 | 0.006 | 0.006 | 0.006 | 0.005 | 0.007 | 0.007 | 0.006 | 0.006 | 0.005 | 0.007 | 0.009 | 0.008 | 0.007 | 0.005 |
| Pb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Th | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 |
| Bi | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.007 | 0.013 | 0.013 | 0.024 | 0.009 | 0.008 | 0.023 | 0.010 | 0.014 | 0.002 | 0.004 | 0.001 | 0.001 | 0.000 |
| Ca | 0.002 | 0.003 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.007 | 0.002 | 0.003 | 0.001 | 0.000 | 0.239 | 0.000 | 0.001 |
| Total | 3.015 | 3.009 | 3.000 | 3.001 | 3.006 | 3.018 | 3.015 | 3.001 | 3.009 | 3.003 | 3.001 | 3.015 | 3.040 | 3.013 | 2.989 |
| Mn/(Mn+Fe) | 0.019 | 0.040 | 0.011 | 0.010 | 0.012 | 0.020 | 0.039 | 0.033 | 0.031 | 0.032 | 0.022 | 0.005 | 0.005 | 0.011 | 0.010 |
| Ta/(Ta+Nb) | 0.901 | 0.887 | 0.858 | 0.860 | 0.860 | 0.841 | 0.830 | 0.836 | 0.863 | 0.860 | 0.870 | 0.852 | 0.876 | 0.886 | 0.871 |
| Comments: | | | | | | | | | | | | | | | |
| | isolated grain | incl. in cass. | many grains close to a tourmaline/microlite-rich veinlet | | | | | | | | | VD & VE same grain | | incl. in cass. | exsolved blob in cass. |
| | | | | | | | | | | | | inclusions in cass. | | | |

**Big Mack pegmatite**
**98-83F**

| | DA1 | DA2 | DA3 | DA4 | DA5 | DA6 | DA7 | DA8 | DA9 | DA10 | DA11 | DA12 | DA13 | DA14 | DA15 | DA16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| FeO | 14.05 | 14.18 | 14.15 | 14.23 | 14.16 | 14.06 | 14.08 | 14.18 | 14.20 | 14.21 | 14.18 | 14.18 | 14.18 | 14.35 | 14.28 | 14.23 |
| MnO | 0.59 | 0.58 | 0.57 | 0.56 | 0.56 | 0.59 | 0.59 | 0.57 | 0.53 | 0.54 | 0.51 | 0.52 | 0.54 | 0.52 | 0.53 | 0.53 |
| TiO2 | 0.43 | 0.45 | 0.44 | 0.44 | 0.46 | 0.44 | 0.47 | 0.47 | 0.48 | 0.49 | 0.46 | 0.44 | 0.43 | 0.46 | 0.46 | 0.46 |
| Nb2O5 | 7.34 | 7.43 | 7.60 | 7.22 | 7.30 | 7.55 | 7.45 | 7.44 | 7.41 | 7.36 | 7.47 | 7.49 | 7.51 | 7.35 | 7.41 | 7.47 |
| Ta2O5 | 76.46 | 76.22 | 76.26 | 76.29 | 75.93 | 75.81 | 75.81 | 76.13 | 76.13 | 76.25 | 76.07 | 75.93 | 76.35 | 76.35 | 76.33 | 76.81 |
| SnO2 | 0.74 | 0.74 | 0.66 | 0.68 | 0.75 | 0.73 | 0.71 | 0.77 | 0.70 | 0.68 | 0.72 | 0.80 | 0.72 | 0.71 | 0.67 | 0.70 |
| WO3 | 0.32 | 0.30 | 0.31 | 0.28 | 0.34 | 0.35 | 0.35 | 0.29 | 0.36 | 0.38 | 0.32 | 0.32 | 0.33 | 0.37 | 0.38 | 0.27 |
| PbO | 0.01 | 0.11 | 0.00 | 0.00 | 0.04 | 0.01 | 0.04 | 0.00 | 0.00 | 0.07 | 0.05 | 0.00 | 0.00 | 0.06 | 0.04 | 0.04 |
| ThO2 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.02 | 0.04 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.05 | 0.02 | 0.00 | 0.00 | 0.03 | 0.02 | 0.03 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 | 0.06 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 |
| Sc2O3 | 0.07 | 0.00 | 0.00 | 0.00 | 0.11 | 0.02 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.04 | 0.00 | 0.00 |
| CaO | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| Total | 100.03 | 100.02 | 100.02 | 99.73 | 99.65 | 99.56 | 99.65 | 99.90 | 99.90 | 100.01 | 99.82 | 99.73 | 100.08 | 100.26 | 100.16 | 100.51 |

**Structural formulae based on 6 oxygens**

| | DA1 | DA2 | DA3 | DA4 | DA5 | DA6 | DA7 | DA8 | DA9 | DA10 | DA11 | DA12 | DA13 | DA14 | DA15 | DA16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.951 | 0.960 | 0.957 | 0.967 | 0.962 | 0.955 | 0.956 | 0.960 | 0.962 | 0.962 | 0.961 | 0.962 | 0.959 | 0.969 | 0.965 | 0.959 |
| Mn | 0.040 | 0.040 | 0.039 | 0.039 | 0.038 | 0.041 | 0.041 | 0.039 | 0.036 | 0.037 | 0.035 | 0.036 | 0.037 | 0.035 | 0.036 | 0.036 |
| Ti | 0.026 | 0.027 | 0.027 | 0.027 | 0.028 | 0.027 | 0.029 | 0.029 | 0.029 | 0.030 | 0.028 | 0.027 | 0.026 | 0.028 | 0.028 | 0.028 |
| Nb | 0.269 | 0.272 | 0.278 | 0.265 | 0.268 | 0.277 | 0.273 | 0.273 | 0.271 | 0.269 | 0.274 | 0.275 | 0.274 | 0.268 | 0.271 | 0.272 |
| Ta | 1.683 | 1.678 | 1.677 | 1.686 | 1.677 | 1.675 | 1.673 | 1.677 | 1.677 | 1.679 | 1.677 | 1.675 | 1.679 | 1.677 | 1.678 | 1.683 |
| Sn | 0.024 | 0.024 | 0.021 | 0.022 | 0.024 | 0.024 | 0.023 | 0.025 | 0.023 | 0.022 | 0.023 | 0.026 | 0.023 | 0.023 | 0.022 | 0.023 |
| W | 0.007 | 0.006 | 0.006 | 0.006 | 0.007 | 0.007 | 0.007 | 0.006 | 0.007 | 0.008 | 0.007 | 0.007 | 0.007 | 0.008 | 0.008 | 0.006 |
| Pb | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.005 | 0.000 | 0.000 | 0.000 | 0.008 | 0.001 | 0.006 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.000 | 0.000 |
| Ca | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Total | 3.006 | 3.011 | 3.006 | 3.012 | 3.013 | 3.007 | 3.010 | 3.009 | 3.009 | 3.009 | 3.008 | 3.008 | 3.006 | 3.014 | 3.010 | 3.006 |
| | | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.041 | 0.040 | 0.039 | 0.039 | 0.038 | 0.041 | 0.041 | 0.039 | 0.036 | 0.037 | 0.035 | 0.036 | 0.037 | 0.035 | 0.036 | 0.036 |
| Ta/(Ta+Nb) | 0.862 | 0.860 | 0.858 | 0.864 | 0.862 | 0.858 | 0.860 | 0.860 | 0.861 | 0.862 | 0.860 | 0.859 | 0.860 | 0.862 | 0.861 | 0.861 |

Comments:

unzoned grain; DA 2700 μm traverse; DA, DB & DC - three relatively large unzoned grains separated from pegmatite

## Ferrotapiolite

| | | | | | | | | | **Big Mack pegmatite** | | | | | | | **Glitter** | **Glitter** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | 98-83F | | | | | | | 99-GZ1 | 99-GZ4 |
| | DB1 | DB2 | DB3 | DB4 | DB5 | DC1 | DC2 | DC3 | DC4 | DC5 | DC6 | DC7 | DC8 | DC9 | DC10 | AF | EP |
| FeO | 14.22 | 14.04 | 14.25 | 14.31 | 14.35 | 14.20 | 14.21 | 14.19 | 14.10 | 14.36 | 14.42 | 14.45 | 14.26 | 14.28 | 14.33 | 14.32 | 13.63 |
| MnO | 0.49 | 0.47 | 0.48 | 0.49 | 0.45 | 0.55 | 0.49 | 0.49 | 0.48 | 0.44 | 0.43 | 0.46 | 0.43 | 0.46 | 0.48 | 0.24 | 0.24 |
| TiO2 | 0.41 | 0.45 | 0.42 | 0.44 | 0.59 | 0.45 | 0.49 | 0.43 | 0.57 | 0.64 | 0.77 | 0.66 | 0.63 | 0.55 | 0.49 | 0.52 | 0.61 |
| Nb2O5 | 7.04 | 7.23 | 7.29 | 7.40 | 7.65 | 7.17 | 7.50 | 7.26 | 7.68 | 7.77 | 7.80 | 7.82 | 7.70 | 7.36 | 7.60 | 10.24 | 6.26 |
| Ta2O5 | 77.56 | 76.94 | 76.37 | 76.32 | 75.82 | 76.38 | 76.05 | 76.20 | 74.92 | 74.95 | 74.73 | 75.52 | 75.53 | 75.60 | 76.28 | 73.46 | 77.33 |
| SnO2 | 0.62 | 0.63 | 0.75 | 0.62 | 0.83 | 0.71 | 0.84 | 0.67 | 0.91 | 0.95 | 0.99 | 0.87 | 0.84 | 0.76 | 0.65 | 1.10 | 0.41 |
| WO3 | 0.28 | 0.28 | 0.33 | 0.34 | 0.40 | 0.34 | 0.33 | 0.25 | 0.33 | 0.39 | 0.40 | 0.39 | 0.30 | 0.33 | 0.38 | 0.27 | 0.18 |
| PbO | 0.00 | 0.03 | 0.05 | 0.04 | 0.00 | 0.00 | 0.03 | 0.00 | 0.04 | 0.03 | 0.07 | 0.02 | 0.08 | 0.03 | 0.00 | 0.05 | 0.06 |
| ThO2 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.02 | 0.01 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.06 | 0.02 | 0.00 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.04 | 0.00 | 0.05 | 0.07 | 0.02 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.00 | 0.08 |
| Sc2O3 | 0.00 | 0.06 | 0.00 | 0.13 | 0.19 | 0.00 | 0.11 | 0.00 | 0.02 | 0.15 | 0.00 | 0.03 | 0.04 | 0.13 | 0.03 | 0.10 | 0.22 |
| CaO | 0.02 | 0.02 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.11 |
| Total | 100.65 | 100.14 | 100.02 | 100.20 | 100.32 | 99.80 | 100.07 | 99.56 | 99.13 | 99.70 | 99.61 | 100.21 | 99.79 | 99.52 | 100.34 | 100.31 | 99.13 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | |
| Fe | 0.959 | 0.950 | 0.966 | 0.967 | 0.964 | 0.964 | 0.959 | 0.966 | 0.960 | 0.969 | 0.974 | 0.970 | 0.963 | 0.969 | 0.965 | 0.949 | 0.936 |
| Mn | 0.034 | 0.033 | 0.033 | 0.033 | 0.031 | 0.038 | 0.034 | 0.034 | 0.033 | 0.030 | 0.030 | 0.031 | 0.030 | 0.032 | 0.033 | 0.016 | 0.017 |
| Ti | 0.025 | 0.027 | 0.025 | 0.027 | 0.036 | 0.028 | 0.030 | 0.026 | 0.035 | 0.039 | 0.047 | 0.040 | 0.038 | 0.034 | 0.030 | 0.031 | 0.037 |
| Nb | 0.257 | 0.265 | 0.267 | 0.270 | 0.278 | 0.263 | 0.274 | 0.267 | 0.282 | 0.284 | 0.284 | 0.284 | 0.281 | 0.270 | 0.277 | 0.367 | 0.232 |
| Ta | 1.702 | 1.693 | 1.684 | 1.676 | 1.656 | 1.687 | 1.670 | 1.687 | 1.658 | 1.645 | 1.641 | 1.650 | 1.660 | 1.668 | 1.671 | 1.583 | 1.726 |
| Sn | 0.020 | 0.020 | 0.024 | 0.020 | 0.027 | 0.023 | 0.027 | 0.022 | 0.029 | 0.030 | 0.032 | 0.028 | 0.027 | 0.025 | 0.021 | 0.035 | 0.013 |
| W | 0.006 | 0.006 | 0.007 | 0.007 | 0.008 | 0.007 | 0.007 | 0.005 | 0.007 | 0.008 | 0.008 | 0.008 | 0.006 | 0.007 | 0.008 | 0.005 | 0.004 |
| Pb | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.002 | 0.000 | 0.002 | 0.001 | 0.000 | 0.001 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.002 |
| Sc | 0.000 | 0.004 | 0.000 | 0.009 | 0.013 | 0.000 | 0.008 | 0.000 | 0.002 | 0.010 | 0.000 | 0.002 | 0.002 | 0.009 | 0.002 | 0.007 | 0.016 |
| Ca | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.010 |
| Total | 3.005 | 3.001 | 3.009 | 3.013 | 3.013 | 3.010 | 3.010 | 3.009 | 3.009 | 3.016 | 3.017 | 3.014 | 3.010 | 3.015 | 3.009 | 2.995 | 2.995 |
| | | | | | | | | | | | | | | | | | |
| Mn/(Mn+Fe) | 0.034 | 0.033 | 0.033 | 0.033 | 0.031 | 0.038 | 0.034 | 0.034 | 0.034 | 0.030 | 0.029 | 0.031 | 0.030 | 0.032 | 0.033 | 0.017 | 0.018 |
| Ta/(Ta+Nb) | 0.869 | 0.865 | 0.863 | 0.861 | 0.856 | 0.865 | 0.859 | 0.863 | 0.854 | 0.853 | 0.852 | 0.853 | 0.855 | 0.861 | 0.858 | 0.812 | 0.881 |
| Comments: | | | | | | | | | | | | | | | | | |
| | | | unzoned grain; DB 1300 μm traverse | | | | | | | unzoned grain; DC 3100 μm traverse | | | | | | inclusion in cass. | inclusion in cass.<br>assoc. Fe col. incls. |

## Pyrochlore Group

| | **Bismutomicrolite** | | | **Microlite** | | | **Antimonian microlite** | | | | | **Stibiomicrolite** | | **Sb mic.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **East Beryl pegmatite** | | | **East Beryl pegmatite** | | | **Lou's pegmatite** | | | | | **Lou's peg.** | | **Lou's** |
| | 93-265A | | | 93-265Rii | | | 93-272B | | | | | 93-272B | | 93-272D |
| | ZV | ZW | ZX | LB | LC | LD | RC | RD | RE | RL | RQ | RK | RS | PE |
| Na2O | 0.03 | 0.00 | 0.15 | 2.65 | 3.24 | 2.53 | 1.99 | 1.80 | 2.36 | 1.33 | 1.68 | 0.47 | 0.95 | 0.60 |
| CaO | 0.71 | 0.51 | 0.47 | 8.86 | 9.91 | 9.41 | 12.72 | 13.06 | 12.94 | 13.35 | 12.91 | 12.54 | 12.94 | 12.37 |
| Al2O3 | 5.22 | 5.07 | 3.83 | | | | | | | | | 0.06 | 0.00 | 0.58 |
| FeO | 4.40 | 4.81 | 4.75 | 1.14 | 1.23 | 2.01 | 0.39 | 0.49 | 0.31 | 0.37 | 0.29 | 1.71 | 0.73 | 1.14 |
| MnO | 0.56 | 1.43 | 2.77 | 0.37 | 0.32 | 0.29 | 0.59 | 0.63 | 0.55 | 0.75 | 0.65 | 0.99 | 0.82 | 0.64 |
| MgO | 0.27 | 0.35 | 0.02 | | | | | | | | | | | |
| TiO2 | 0.09 | 0.10 | 0.12 | 0.11 | 0.11 | 0.18 | 3.32 | 3.62 | 2.53 | 4.61 | 4.61 | 4.88 | 4.27 | 1.93 |
| Nb2O5 | 4.84 | 5.00 | 6.32 | 0.77 | 0.97 | 1.07 | 7.11 | 7.42 | 6.81 | 6.42 | 5.99 | 11.40 | 6.10 | 6.30 |
| Ta2O5 | 37.26 | 41.00 | 42.21 | 80.08 | 78.19 | 78.52 | 63.04 | 62.66 | 65.84 | 62.12 | 62.64 | 47.40 | 59.47 | 58.46 |
| SnO2 | 2.07 | 3.28 | 4.52 | 0.55 | 0.55 | 0.55 | 1.37 | 1.48 | 1.14 | 0.98 | 0.86 | 3.10 | 1.85 | 4.48 |
| WO3 | 0.57 | 0.86 | 2.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.14 | 0.19 |
| PbO | 5.65 | 4.27 | 4.82 | 0.49 | 0.40 | 0.42 | 0.64 | 0.62 | 0.59 | 0.39 | 0.62 | 0.58 | 0.37 | 0.07 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.00 | 0.04 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.02 |
| UO2 | 3.44 | 2.59 | 2.10 | 1.82 | 1.91 | 1.77 | 0.12 | 0.15 | 0.19 | 0.17 | 0.26 | 0.11 | 0.17 | 0.17 |
| Sb2O3 | 0.34 | 0.29 | 0.21 | 0.17 | 0.19 | 0.20 | 7.23 | 7.70 | 5.46 | 8.42 | 8.00 | 15.75 | 10.66 | 11.79 |
| Bi2O3 | 13.83 | 10.16 | 9.63 | 0.07 | 0.02 | 0.02 | 0.03 | 0.03 | 0.05 | 0.00 | 0.03 | 0.02 | 0.03 | 0.00 |
| Sc2O3 | 0.05 | 0.03 | 0.02 | 0.02 | 0.02 | 0.00 | 0.00 | 0.03 | 0.02 | 0.03 | 0.03 | 0.03 | 0.05 | 0.02 |
| Cs2O | | | | | | | | | | | | | | |
| BaO | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | |
| F | 0.25 | 0.25 | 0.05 | 2.28 | 2.51 | 2.39 | 2.00 | 1.78 | 2.35 | 1.50 | 1.58 | 0.93 | 1.43 | 0.98 |
| H2O* | 2.58 | 2.71 | 3.01 | 1.26 | 0.99 | 1.13 | 1.79 | 2.08 | 1.41 | 2.37 | 2.26 | 3.02 | 2.37 | 2.81 |
| Subtotal | 82.16 | 82.71 | 87.18 | 100.64 | 100.58 | 100.50 | 102.34 | 103.59 | 102.55 | 102.82 | 102.47 | 102.99 | 102.35 | 102.55 |
| O=F | 0.11 | 0.11 | 0.02 | 0.96 | 1.06 | 1.01 | 0.84 | 0.75 | 0.99 | 0.63 | 0.67 | 0.39 | 0.60 | 0.41 |
| Total | 82.06 | 82.61 | 87.16 | 99.68 | 99.52 | 99.49 | 101.50 | 102.84 | 101.56 | 102.19 | 101.81 | 102.60 | 101.75 | 102.13 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Ti | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.012 | 0.213 | 0.230 | 0.163 | 0.293 | 0.294 | 0.319 | 0.280 | 0.128 |
| Nb | 0.224 | 0.215 | 0.268 | 0.031 | 0.040 | 0.044 | 0.275 | 0.283 | 0.264 | 0.245 | 0.230 | 0.448 | 0.241 | 0.251 |
| Ta | 1.039 | 1.062 | 1.077 | 1.942 | 1.933 | 1.924 | 1.465 | 1.438 | 1.534 | 1.428 | 1.446 | 1.120 | 1.412 | 1.400 |
| W | 0.015 | 0.021 | 0.053 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.004 |
| Sn | 0.085 | 0.125 | 0.169 | 0.020 | 0.020 | 0.020 | 0.047 | 0.050 | 0.039 | 0.033 | 0.029 | 0.107 | 0.064 | 0.157 |
| Al | 0.631 | 0.569 | 0.424 | | | | | | | | | 0.006 | 0.000 | 0.060 |
| Fe | 0.377 | 0.383 | 0.373 | 0.085 | 0.093 | 0.151 | 0.028 | 0.035 | 0.022 | 0.026 | 0.021 | 0.124 | 0.053 | 0.084 |
| Mn | 0.049 | 0.115 | 0.220 | 0.028 | 0.025 | 0.022 | 0.043 | 0.045 | 0.040 | 0.054 | 0.047 | 0.073 | 0.061 | 0.048 |
| Mg | 0.041 | 0.050 | 0.003 | | | | | | | | | | | |
| Ca | 0.078 | 0.052 | 0.047 | 0.847 | 0.965 | 0.909 | 1.165 | 1.180 | 1.188 | 1.209 | 1.174 | 1.167 | 1.210 | 1.167 |
| Na | 0.006 | 0.000 | 0.027 | 0.458 | 0.571 | 0.442 | 0.330 | 0.294 | 0.392 | 0.218 | 0.276 | 0.079 | 0.161 | 0.102 |
| K | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | |
| Pb | 0.156 | 0.110 | 0.122 | 0.012 | 0.010 | 0.010 | 0.015 | 0.014 | 0.014 | 0.009 | 0.014 | 0.014 | 0.009 | 0.002 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.078 | 0.055 | 0.044 | 0.036 | 0.039 | 0.035 | 0.002 | 0.003 | 0.004 | 0.003 | 0.005 | 0.002 | 0.003 | 0.003 |
| Sb | 0.014 | 0.011 | 0.008 | 0.006 | 0.007 | 0.007 | 0.255 | 0.268 | 0.193 | 0.294 | 0.280 | 0.564 | 0.384 | 0.428 |
| Bi | 0.366 | 0.250 | 0.233 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Cs | | | | | | | | | | | | | | |
| Sc | 0.004 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 | 0.000 | 0.002 | 0.001 | 0.002 | 0.002 | 0.002 | 0.004 | 0.002 |
| Y | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | |
| F | 0.081 | 0.075 | 0.015 | 0.643 | 0.721 | 0.681 | 0.541 | 0.475 | 0.637 | 0.401 | 0.424 | 0.256 | 0.395 | 0.273 |
| OH* | 0.919 | 0.925 | 0.985 | 0.357 | 0.279 | 0.319 | 0.459 | 0.525 | 0.363 | 0.599 | 0.576 | 0.744 | 0.605 | 0.727 |
| Total | 4.170 | 4.028 | 4.079 | 4.475 | 4.712 | 4.578 | 4.838 | 4.843 | 4.855 | 4.815 | 4.819 | 5.026 | 4.885 | 4.836 |
| Comments: | | single crystal | | LB - LD | | | | | | | | C, D & E sa very high Sn values | | |
| | | inclusion in | | same grain | | | | | | | | incl. in cass. for microlite | | |
| | | wodginit altered sample | | | | | | | | | | assoc. Sc columbite | | |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

| | **Stibiomicrolite** | | | | | | **Microlite** | | | | | | | **Microlite** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Lou's pegmatite** | | | | | | **Marko's pegmatite** | | | | | | | **Marko's pegmatite** | | |
| | 93-272E | | | | | | 94-44A | | | | | | | 94-44D | | |
| | WG | WM | WN | WI | VD | VE | VI | VO | VP | VV | VW | KC | KD | KK | JE | JF |
| Na2O | 1.75 | 0.58 | 1.60 | 0.72 | 4.86 | 4.79 | 4.89 | 5.03 | 5.06 | 5.06 | 4.84 | 5.36 | 5.21 | 4.52 | 4.92 | 4.92 |
| CaO | 13.59 | 13.80 | 13.72 | 12.24 | 11.91 | 12.46 | 12.49 | 12.24 | 12.14 | 12.11 | 12.31 | 11.78 | 11.72 | 11.31 | 12.08 | 11.99 |
| Al2O3 | | | | | | | | | | | | | | | | |
| FeO | 0.70 | 1.06 | 0.20 | 0.42 | 0.02 | 0.02 | 0.06 | 0.05 | 0.06 | 0.05 | 0.07 | 0.01 | 0.07 | 0.25 | 0.07 | 0.08 |
| MnO | 0.55 | 0.28 | 0.40 | 0.30 | 0.07 | 0.09 | 0.07 | 0.04 | 0.04 | 0.10 | 0.03 | 0.07 | 0.08 | 0.10 | 0.09 | 0.03 |
| MgO | | | | | | | | | | | | | | | | |
| TiO2 | 5.95 | 5.34 | 4.15 | 6.29 | 0.91 | 0.98 | 1.11 | 1.01 | 0.82 | 0.84 | 1.23 | 0.63 | 0.63 | 0.63 | 0.61 | 0.66 |
| Nb2O5 | 7.10 | 11.47 | 5.38 | 8.98 | 2.70 | 4.97 | 3.54 | 3.17 | 2.94 | 2.95 | 6.15 | 2.55 | 2.44 | 2.35 | 2.77 | 2.33 |
| Ta2O5 | 54.29 | 48.01 | 63.95 | 42.98 | 74.78 | 70.79 | 74.49 | 74.47 | 75.03 | 74.15 | 68.74 | 73.22 | 74.29 | 74.63 | 74.32 | 73.46 |
| SnO2 | 2.17 | 2.70 | 1.09 | 15.30 | 1.27 | 1.75 | 0.85 | 1.10 | 0.89 | 1.39 | 1.67 | 1.21 | 1.15 | 1.16 | 1.21 | 1.06 |
| WO3 | 0.08 | 0.00 | 0.00 | 0.12 | 0.00 | 0.06 | 0.05 | 0.00 | 0.03 | 0.00 | 0.15 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PbO | 0.43 | 0.54 | 0.39 | 0.48 | 0.05 | 0.02 | 0.02 | 0.03 | 0.00 | 0.03 | 0.09 | 0.12 | 0.10 | 0.07 | 0.19 | 0.21 |
| ThO2 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.05 | 0.01 | 0.01 | 0.03 | 0.00 | 0.01 | 0.04 | 0.00 | 0.05 | 0.05 | 0.04 |
| UO2 | 0.12 | 0.11 | 0.39 | 0.19 | 0.08 | 0.03 | 0.00 | 0.02 | 0.00 | 0.05 | 0.05 | 0.64 | 0.53 | 0.48 | 0.63 | 0.94 |
| Sb2O3 | 11.62 | 12.73 | 6.29 | 10.60 | 0.98 | 1.20 | 0.56 | 0.93 | 0.51 | 0.82 | 1.51 | 1.12 | 1.08 | 1.09 | 1.02 | 1.05 |
| Bi2O3 | 0.02 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.02 | 0.02 | 0.00 | 0.04 | 0.04 | 0.00 | 0.02 | 0.02 |
| Sc2O3 | 0.03 | 0.02 | 0.00 | 0.03 | 0.00 | 0.00 | 0.05 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.00 |
| Cs2O | | | | | | | | | | | | | | | | |
| BaO | | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | | | |
| F | 1.34 | 1.23 | 2.02 | 1.11 | 3.87 | 3.98 | 3.74 | 3.86 | 3.89 | 4.11 | 4.18 | 4.09 | 3.95 | 3.72 | 4.08 | 4.30 |
| H2O* | 2.56 | 2.68 | 1.76 | 3.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Subtotal | 102.30 | 100.57 | 101.36 | 102.79 | 101.57 | 101.19 | 101.92 | 102.02 | 101.48 | 101.68 | 101.03 | 100.88 | 101.31 | 100.38 | 102.08 | 101.09 |
| O=F | 0.56 | 0.52 | 0.85 | 0.47 | 1.63 | 1.68 | 1.57 | 1.63 | 1.64 | 1.73 | 1.76 | 1.72 | 1.66 | 1.57 | 1.72 | 1.81 |
| Total | 101.73 | 100.05 | 100.51 | 102.32 | 99.94 | 99.51 | 100.35 | 100.39 | 99.84 | 99.95 | 99.27 | 99.16 | 99.65 | 98.81 | 100.36 | 99.28 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Ti | 0.384 | 0.344 | 0.267 | 0.356 | 0.060 | 0.064 | 0.072 | 0.066 | 0.054 | 0.056 | 0.080 | 0.043 | 0.043 | 0.043 | 0.041 | 0.045 |
| Nb | 0.275 | 0.444 | 0.208 | 0.305 | 0.107 | 0.196 | 0.139 | 0.125 | 0.117 | 0.118 | 0.241 | 0.105 | 0.099 | 0.095 | 0.112 | 0.096 |
| Ta | 1.265 | 1.119 | 1.488 | 0.878 | 1.788 | 1.678 | 1.758 | 1.770 | 1.797 | 1.778 | 1.618 | 1.808 | 1.817 | 1.821 | 1.804 | 1.820 |
| W | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sn | 0.074 | 0.092 | 0.037 | 0.459 | 0.045 | 0.061 | 0.029 | 0.038 | 0.031 | 0.049 | 0.058 | 0.044 | 0.041 | 0.041 | 0.043 | 0.039 |
| Al | | | | | | | | | | | | | | | | |
| Fe | 0.050 | 0.076 | 0.014 | 0.026 | 0.001 | 0.001 | 0.004 | 0.004 | 0.004 | 0.004 | 0.005 | 0.001 | 0.005 | 0.019 | 0.005 | 0.006 |
| Mn | 0.040 | 0.020 | 0.029 | 0.019 | 0.005 | 0.007 | 0.005 | 0.003 | 0.003 | 0.007 | 0.002 | 0.005 | 0.006 | 0.008 | 0.007 | 0.002 |
| Mg | | | | | | | | | | | | | | | | |
| Ca | 1.248 | 1.257 | 1.258 | 0.986 | 1.122 | 1.164 | 1.162 | 1.146 | 1.145 | 1.144 | 1.142 | 1.146 | 1.129 | 1.087 | 1.155 | 1.171 |
| Na | 0.291 | 0.096 | 0.265 | 0.105 | 0.828 | 0.809 | 0.823 | 0.852 | 0.864 | 0.865 | 0.812 | 0.944 | 0.908 | 0.786 | 0.852 | 0.869 |
| K | | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | | |
| Pb | 0.010 | 0.012 | 0.009 | 0.010 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.002 | 0.003 | 0.002 | 0.002 | 0.005 | 0.005 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 |
| U | 0.002 | 0.002 | 0.007 | 0.003 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.013 | 0.011 | 0.010 | 0.013 | 0.019 |
| Sb | 0.411 | 0.450 | 0.222 | 0.328 | 0.036 | 0.043 | 0.020 | 0.034 | 0.019 | 0.030 | 0.054 | 0.042 | 0.040 | 0.040 | 0.038 | 0.039 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Cs | | | | | | | | | | | | | | | | |
| Sc | 0.002 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 | 0.004 | 0.002 | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.000 |
| Y | | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | | | |
| F | 0.363 | 0.333 | 0.546 | 0.264 | 1.076 | 1.097 | 1.027 | 1.067 | 1.083 | 1.146 | 1.144 | 1.175 | 1.123 | 1.055 | 1.152 | 1.239 |
| OH* | 0.637 | 0.667 | 0.454 | 0.736 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 5.054 | 4.926 | 4.805 | 4.479 | 5.073 | 5.123 | 5.045 | 5.109 | 5.121 | 5.198 | 5.163 | 5.331 | 5.228 | 5.009 | 5.228 | 5.352 |
| Comments: | wispy incl. in cass. | | | stannoan | | | | | | | | KC - JE same grain | | | | |
| | | | antimonian | | | | | | | | | replaces wodginite | | | | |

| | **Microlite** | | | | | | | | **Microlite** | | | | | **Sb Mic.** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Marko's pegmatite** | | | | | | | | **Marko's pegmatite** | | | | | **Marko's** |
| | 94-44E | | | | | | | | 94-44E | | | | | 94-44I |
| | KC | KD | KG | KL | PI | PN | PR | PS | HA | HF | HJ | HM | HN | SW |
| Na2O | 5.36 | 5.32 | 5.31 | 5.47 | 4.74 | 3.69 | 5.29 | 3.91 | 5.10 | 5.37 | 3.49 | 5.38 | 5.02 | 0.00 |
| CaO | 11.95 | 12.14 | 11.73 | 11.60 | 11.72 | 8.80 | 11.91 | 8.64 | 11.80 | 11.82 | 9.62 | 11.67 | 11.29 | 12.78 |
| Al2O3 | | | | | 0.09 | | | | | | | | | 0.38 |
| FeO | 0.03 | 0.01 | 0.03 | 0.05 | 0.06 | 0.50 | 0.06 | 0.47 | 0.03 | 0.06 | 0.64 | 0.03 | 0.03 | 0.67 |
| MnO | 0.03 | 0.11 | 0.04 | 0.10 | 0.39 | 3.88 | 0.14 | 3.97 | 0.09 | 0.10 | 6.26 | 0.10 | 0.03 | 1.08 |
| MgO | | | | | | | | | | | | | | |
| TiO2 | 0.63 | 0.66 | 0.71 | 0.68 | 0.93 | 1.02 | 0.90 | 0.91 | 0.82 | 0.74 | 1.17 | 0.85 | 1.02 | 12.63 |
| Nb2O5 | 3.46 | 3.73 | 4.32 | 4.01 | 4.62 | 8.79 | 4.24 | 10.91 | 3.52 | 3.28 | 14.85 | 4.03 | 4.15 | 9.91 |
| Ta2O5 | 73.61 | 72.53 | 71.91 | 73.16 | 72.54 | 68.68 | 71.63 | 66.14 | 73.55 | 73.75 | 59.24 | 70.79 | 71.37 | 35.03 |
| SnO2 | 1.17 | 1.20 | 1.23 | 1.58 | 1.12 | 0.98 | 1.17 | 1.03 | 1.60 | 1.48 | 1.24 | 2.42 | 2.75 | 3.11 |
| WO3 | 0.03 | 0.03 | 0.00 | 0.01 | 0.04 | 0.10 | 0.10 | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.48 |
| PbO | 0.07 | 0.05 | 0.03 | 0.00 | 0.02 | 0.05 | 0.07 | 0.05 | 0.02 | 0.03 | 0.02 | 0.05 | 0.00 | 0.13 |
| ThO2 | 0.02 | 0.02 | 0.04 | 0.05 | 0.02 | 0.01 | 0.01 | 0.00 | 0.04 | 0.05 | 0.00 | 0.20 | 0.00 | 0.05 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.26 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.20 | 0.03 | 0.17 | 0.25 | 0.21 |
| Sb2O3 | 0.87 | 1.04 | 1.15 | 1.15 | | | | | 1.03 | 1.01 | 1.09 | 1.35 | 1.50 | 20.91 |
| Bi2O3 | 0.04 | 0.09 | 0.06 | 0.00 | | | | | 0.05 | 0.02 | 0.02 | 0.00 | 0.00 | 0.07 |
| Sc2O3 | 0.00 | 0.02 | 0.00 | 0.00 | | | | | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.10 |
| Cs2O | | | | | | | | | | | | | | |
| BaO | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | |
| F | 3.73 | 3.96 | 4.01 | 4.07 | 4.31 | 3.08 | 3.90 | 3.36 | 4.12 | 4.15 | 3.59 | 4.56 | 4.48 | 0.44 |
| H2O* | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.69 | 0.00 | 0.45 | 0.00 | 0.00 | 0.25 | 0.00 | 0.00 | 3.82 |
| Subtotal | 101.00 | 100.91 | 100.57 | 102.19 | 100.60 | 100.27 | 99.42 | 100.02 | 101.92 | 102.06 | 101.51 | 101.62 | 101.89 | 101.80 |
| O=F | 1.57 | 1.67 | 1.69 | 1.71 | 1.81 | 1.30 | 1.64 | 1.41 | 1.73 | 1.75 | 1.51 | 1.92 | 1.89 | 0.19 |
| Total | 99.43 | 99.24 | 98.88 | 100.48 | 98.79 | 98.97 | 97.78 | 98.60 | 100.19 | 100.31 | 99.99 | 99.70 | 100.00 | 101.62 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | |
| Ti | 0.042 | 0.044 | 0.047 | 0.045 | 0.061 | 0.064 | 0.060 | 0.057 | 0.054 | 0.049 | 0.073 | 0.056 | 0.066 | 0.750 |
| Nb | 0.139 | 0.151 | 0.173 | 0.159 | 0.181 | 0.333 | 0.170 | 0.410 | 0.139 | 0.131 | 0.555 | 0.161 | 0.162 | 0.354 |
| Ta | 1.777 | 1.762 | 1.736 | 1.741 | 1.710 | 1.567 | 1.726 | 1.495 | 1.751 | 1.768 | 1.332 | 1.698 | 1.677 | 0.753 |
| W | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 |
| Sn | 0.041 | 0.043 | 0.044 | 0.055 | 0.039 | 0.033 | 0.041 | 0.034 | 0.056 | 0.052 | 0.041 | 0.085 | 0.095 | 0.098 |
| Al | | | | | 0.009 | | | | | | | | | 0.035 |
| Fe | 0.002 | 0.001 | 0.002 | 0.004 | 0.004 | 0.035 | 0.004 | 0.033 | 0.002 | 0.004 | 0.044 | 0.002 | 0.002 | 0.044 |
| Mn | 0.002 | 0.008 | 0.003 | 0.007 | 0.029 | 0.276 | 0.011 | 0.280 | 0.007 | 0.007 | 0.438 | 0.007 | 0.002 | 0.072 |
| Mg | | | | | | | | | | | | | | |
| Ca | 1.137 | 1.162 | 1.116 | 1.088 | 1.088 | 0.791 | 1.131 | 0.770 | 1.107 | 1.117 | 0.852 | 1.103 | 1.045 | 1.082 |
| Na | 0.923 | 0.921 | 0.914 | 0.928 | 0.796 | 0.600 | 0.909 | 0.630 | 0.866 | 0.918 | 0.559 | 0.920 | 0.841 | 0.000 |
| K | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | |
| Pb | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.003 |
| Th | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.004 | 0.000 | 0.001 |
| U | 0.000 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.004 | 0.001 | 0.003 | 0.005 | 0.004 |
| Sb | 0.032 | 0.038 | 0.042 | 0.041 | | | | | 0.037 | 0.037 | 0.037 | 0.049 | 0.053 | 0.681 |
| Bi | 0.001 | 0.002 | 0.001 | 0.000 | | | | | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Cs | | | | | | | | | | | | | | |
| Sc | 0.000 | 0.002 | 0.000 | 0.000 | | | | | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.007 |
| Y | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | |
| F | 1.047 | 1.118 | 1.126 | 1.126 | 1.181 | 0.817 | 1.093 | 0.883 | 1.141 | 1.157 | 0.938 | 1.272 | 1.224 | 0.110 |
| OH* | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.183 | 0.000 | 0.117 | 0.000 | 0.000 | 0.062 | 0.000 | 0.000 | 0.890 |
| Total | 5.146 | 5.254 | 5.205 | 5.201 | 5.100 | 4.704 | 5.150 | 4.713 | 5.164 | 5.246 | 4.932 | 5.363 | 5.173 | 4.895 |
| Comments: | | | | | assoc. with coarse beryl & zinnwaldite<br>microlite with blobby textured<br>cassiterite inclusions | | | | | | | | | |

|  | Microlite |  |  | Antimonian microlite |  |  | Sb microlite |  | Microlite |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Marko's pegmatite |  |  | Marko's pegmatite |  |  | Marko's peg. |  | Marko's pegmatite |  |  |  |  |  |
|  | 94-44J |  |  | 94-44J |  |  | 94-44J |  | 94-44J |  |  |  |  |  |
|  | EC | EG | EH | EA | EB | ED | EE | EF | JA | JB | JE | JC | JD | JF |
| Na2O | 4.62 | 5.01 | 4.82 | 3.86 | 3.87 | 3.19 | 4.99 | 4.04 | 5.04 | 4.64 | 3.55 | 3.82 | 2.69 | 3.22 |
| CaO | 12.49 | 13.33 | 12.78 | 12.72 | 12.75 | 12.81 | 13.04 | 13.25 | 12.06 | 12.06 | 10.39 | 10.98 | 10.73 | 11.19 |
| Al2O3 |  |  |  | 0.00 | 0.00 | 0.00 | 0.19 | 0.00 |  |  |  |  |  |  |
| FeO | 0.08 | 0.05 | 0.14 | 0.06 | 0.06 | 0.07 | 0.07 | 0.12 | 0.05 | 0.03 | 0.37 | 0.37 | 0.22 | 0.69 |
| MnO | 0.26 | 0.05 | 0.21 | 0.30 | 0.22 | 0.43 | 0.28 | 0.35 | 0.04 | 0.05 | 0.05 | 0.08 | 0.12 | 0.17 |
| MgO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TiO2 | 4.13 | 3.13 | 3.97 | 5.26 | 5.28 | 6.49 | 5.38 | 5.31 | 2.05 | 2.80 | 2.40 | 1.92 | 2.32 | 2.58 |
| Nb2O5 | 5.12 | 5.06 | 4.66 | 5.50 | 5.60 | 5.63 | 6.19 | 5.04 | 3.81 | 4.86 | 4.37 | 3.91 | 5.28 | 5.64 |
| Ta2O5 | 61.73 | 65.55 | 62.33 | 57.51 | 57.82 | 55.61 | 58.13 | 59.73 | 71.04 | 66.83 | 69.82 | 70.33 | 68.41 | 65.73 |
| SnO2 | 1.51 | 1.33 | 1.54 | 1.73 | 2.02 | 1.90 | 1.75 | 1.72 | 1.30 | 1.51 | 1.13 | 1.10 | 1.17 | 1.34 |
| WO3 | 0.02 | 0.00 | 0.00 | 0.00 | 0.02 | 0.07 | 0.00 | 0.00 | 0.00 | 0.07 | 0.00 | 0.01 | 0.00 | 0.00 |
| PbO | 0.03 | 0.00 | 0.00 | 0.07 | 0.07 | 0.07 | 0.05 | 0.03 | 0.03 | 0.12 | 0.10 | 0.26 | 0.28 | 0.34 |
| ThO2 | 0.06 | 0.01 | 0.01 | 0.05 | 0.05 | 0.04 | 0.03 | 0.01 | 0.03 | 0.04 | 0.02 | 0.05 | 0.02 | 0.08 |
| UO2 | 0.17 | 0.00 | 0.00 | 0.12 | 0.14 | 0.17 | 0.15 | 0.00 | 0.37 | 0.40 | 0.34 | 1.13 | 1.43 | 1.35 |
| Sb2O3 | 5.66 | 3.82 | 4.96 | 7.84 | 7.76 | 9.90 | 7.88 | 7.60 | 2.08 | 3.60 | 2.43 | 2.07 | 2.41 | 2.70 |
| Bi2O3 | 0.04 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.04 | 0.00 | 0.02 |
| Sc2O3 | 0.05 | 0.00 | 0.16 | 0.03 | 0.03 | 0.08 | 0.05 | 0.05 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 |
| Cs2O |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BaO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| K2O |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Y2O3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SiO2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| F | 4.01 | 4.43 | 4.01 | 3.54 | 3.68 | 2.86 | 3.45 | 3.82 | 4.26 | 3.78 | 3.38 | 3.27 | 2.76 | 2.78 |
| H2O* | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.89 | 0.30 | 0.00 | 0.00 | 0.00 | 0.29 | 0.34 | 0.91 | 0.86 |
| Subtotal | 99.98 | 101.77 | 99.59 | 98.65 | 99.40 | 100.21 | 101.93 | 101.07 | 102.16 | 100.79 | 98.68 | 99.68 | 98.77 | 98.69 |
| O=F | 1.69 | 1.87 | 1.69 | 1.49 | 1.55 | 1.20 | 1.45 | 1.61 | 1.79 | 1.59 | 1.42 | 1.38 | 1.16 | 1.17 |
| Total | 98.29 | 99.90 | 97.90 | 97.16 | 97.85 | 99.00 | 100.48 | 99.46 | 100.37 | 99.20 | 97.26 | 98.30 | 97.61 | 97.52 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ti | 0.272 | 0.205 | 0.264 | 0.347 | 0.345 | 0.418 | 0.343 | 0.344 | 0.133 | 0.182 | 0.155 | 0.127 | 0.150 | 0.169 |
| Nb | 0.203 | 0.199 | 0.186 | 0.218 | 0.220 | 0.218 | 0.237 | 0.196 | 0.149 | 0.190 | 0.170 | 0.155 | 0.206 | 0.223 |
| Ta | 1.472 | 1.550 | 1.496 | 1.374 | 1.365 | 1.297 | 1.341 | 1.400 | 1.673 | 1.574 | 1.636 | 1.679 | 1.604 | 1.561 |
| W | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sn | 0.053 | 0.046 | 0.054 | 0.061 | 0.070 | 0.065 | 0.059 | 0.059 | 0.045 | 0.052 | 0.039 | 0.039 | 0.040 | 0.047 |
| Al |  |  |  | 0.000 | 0.000 | 0.000 | 0.019 | 0.000 |  |  |  |  |  |  |
| Fe | 0.006 | 0.003 | 0.010 | 0.004 | 0.004 | 0.005 | 0.005 | 0.008 | 0.004 | 0.002 | 0.027 | 0.027 | 0.016 | 0.050 |
| Mn | 0.019 | 0.004 | 0.016 | 0.022 | 0.016 | 0.031 | 0.020 | 0.026 | 0.003 | 0.004 | 0.004 | 0.006 | 0.009 | 0.013 |
| Mg |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ca | 1.173 | 1.242 | 1.209 | 1.197 | 1.186 | 1.177 | 1.185 | 1.224 | 1.119 | 1.119 | 0.959 | 1.033 | 0.991 | 1.047 |
| Na | 0.785 | 0.845 | 0.825 | 0.657 | 0.651 | 0.530 | 0.821 | 0.676 | 0.846 | 0.779 | 0.593 | 0.650 | 0.450 | 0.545 |
| K |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ba |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pb | 0.001 | 0.000 | 0.000 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.003 | 0.002 | 0.006 | 0.006 | 0.008 |
| Th | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.002 |
| U | 0.003 | 0.000 | 0.000 | 0.002 | 0.003 | 0.003 | 0.003 | 0.000 | 0.007 | 0.008 | 0.007 | 0.022 | 0.027 | 0.026 |
| Sb | 0.205 | 0.137 | 0.181 | 0.284 | 0.278 | 0.350 | 0.276 | 0.270 | 0.074 | 0.129 | 0.086 | 0.075 | 0.086 | 0.097 |
| Bi | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Cs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sc | 0.004 | 0.000 | 0.012 | 0.002 | 0.002 | 0.006 | 0.004 | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 |
| Y |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Si |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| F | 1.112 | 1.218 | 1.119 | 0.983 | 1.010 | 0.776 | 0.926 | 1.041 | 1.166 | 1.035 | 0.921 | 0.908 | 0.752 | 0.768 |
| OH* | 0.000 | 0.000 | 0.000 | 0.017 | 0.000 | 0.224 | 0.074 | 0.000 | 0.000 | 0.000 | 0.079 | 0.092 | 0.248 | 0.232 |
| Total | 5.310 | 5.449 | 5.373 | 5.172 | 5.154 | 5.105 | 5.315 | 5.250 | 5.220 | 5.079 | 4.680 | 4.821 | 4.587 | 4.789 |
| Comments: |  |  |  |  |  |  |  |  | A, B & E same grain<br>attached to edge<br>of cassiterite |  |  | C, D & F same grain<br>BSE shows appreciable<br>internal alteration |  |  |

|  | Stibiomicrolite |  |  |  |  | Microlite |  |  |  |  |  | Microlite |  | Microlite |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | Marko's pegmatite |  |  |  |  | Marko's pegmatite |  |  |  |  |  | Marko's peg. |  | Marko's pegmatite |  |  |  |
|  | 94-44K |  |  |  |  | 94-44R |  |  |  |  |  | 94-44T |  | 94-44V |  |  |  |
|  | CK | CM | CP | CQ | ZG | DL | YE | YF | YK | YL | YM | EC | ED | EF | EH | EI | EJ |
| Na2O | 2.54 | 3.61 | 4.00 | 4.05 | 4.23 | 3.91 | 4.90 | 4.96 | 5.00 | 3.89 | 3.51 | 3.02 | 4.40 | 2.36 | 5.20 | 5.41 | 5.11 |
| CaO | 12.56 | 12.65 | 12.50 | 12.57 | 11.87 | 9.02 | 11.99 | 12.20 | 12.30 | 9.59 | 9.94 | 8.99 | 11.20 | 6.21 | 12.22 | 11.94 | 11.55 |
| Al2O3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| FeO | 0.18 | 0.15 | 0.18 | 0.14 | 0.09 | 0.26 | 0.08 | 0.01 | 0.05 | 0.08 | 0.02 | 0.22 | 0.07 | 1.22 | 0.11 | 0.02 | 0.17 |
| MnO | 0.56 | 0.50 | 0.65 | 0.67 | 0.21 | 0.13 | 0.34 | 0.21 | 0.17 | 0.41 | 0.23 | 0.22 | 0.12 | 7.96 | 0.14 | 0.25 | 0.72 |
| MgO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| TiO2 | 8.55 | 8.44 | 8.97 | 9.10 | 5.09 | 0.94 | 1.02 | 0.90 | 1.04 | 0.87 | 0.75 | 0.67 | 0.61 | 1.10 | 1.14 | 0.81 | 0.95 |
| Nb2O5 | 9.44 | 9.40 | 10.00 | 11.54 | 9.64 | 3.12 | 3.24 | 2.72 | 3.73 | 2.28 | 2.56 | 4.01 | 4.13 | 13.53 | 3.55 | 3.06 | 3.82 |
| Ta2O5 | 47.24 | 48.62 | 46.65 | 43.89 | 58.10 | 74.97 | 73.06 | 75.61 | 73.88 | 74.18 | 76.53 | 76.79 | 76.44 | 66.25 | 75.50 | 76.25 | 76.28 |
| SnO2 | 1.58 | 1.67 | 1.60 | 1.20 | 1.33 | 1.64 | 1.77 | 1.24 | 1.45 | 1.32 | 1.20 | 1.17 | 1.30 | 0.81 | 1.04 | 0.92 | 1.15 |
| WO3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.14 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.15 | 0.03 | 0.01 | 0.00 |
| PbO | 0.05 | 0.08 | 0.07 | 0.05 | 0.08 | 0.40 | 0.10 | 0.05 | 0.07 | 0.75 | 0.59 | 0.14 | 0.02 | 0.14 | 0.03 | 0.09 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.00 | 0.04 | 0.02 | 0.03 | 0.03 | 0.00 | 0.03 | 0.04 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.20 | 0.23 | 0.20 | 0.17 | 2.49 | 1.53 | 0.40 | 0.09 | 0.00 | 0.00 | 0.08 | 0.00 |
| Sb2O3 | 14.31 | 13.69 | 14.22 | 14.76 | 6.23 | 1.03 | 1.33 | 0.95 | 1.24 | 0.68 | 0.62 | 1.30 | 1.12 |  |  |  |  |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.04 |  |  |  |  |  |  |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |  |  |  |  |  |  |
| Cs2O |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| BaO |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| K2O |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Y2O3 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| SiO2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| F | 2.28 | 2.37 | 1.92 | 2.43 | 3.67 | 2.87 | 4.17 | 4.18 | 4.02 | 3.16 | 3.08 | 2.44 | 3.35 | 2.03 | 3.86 | 3.85 | 3.58 |
| H2O* | 1.66 | 1.62 | 2.14 | 1.58 | 0.21 | 0.78 | 0.00 | 0.00 | 0.00 | 0.38 | 0.56 | 1.26 | 0.39 | 1.96 | 0.00 | 0.00 | 0.16 |
| Subtotal | 100.95 | 102.80 | 102.90 | 101.98 | 100.75 | 100.27 | 102.45 | 103.37 | 103.17 | 100.12 | 101.18 | 100.66 | 103.27 | 103.72 | 102.85 | 102.73 | 103.49 |
| O=F | 0.96 | 1.00 | 0.81 | 1.02 | 1.55 | 1.21 | 1.76 | 1.76 | 1.69 | 1.33 | 1.30 | 1.03 | 1.41 | 0.85 | 1.63 | 1.62 | 1.51 |
| Total | 99.99 | 101.81 | 102.09 | 100.95 | 99.21 | 99.06 | 100.69 | 101.61 | 101.48 | 98.79 | 99.88 | 99.64 | 101.86 | 102.86 | 101.22 | 101.11 | 101.98 |
|  | **Structural formulae based on 6 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ti | 0.532 | 0.518 | 0.549 | 0.559 | 0.312 | 0.061 | 0.067 | 0.059 | 0.068 | 0.058 | 0.049 | 0.043 | 0.039 | 0.065 | 0.073 | 0.053 | 0.060 |
| Nb | 0.353 | 0.347 | 0.368 | 0.426 | 0.356 | 0.122 | 0.128 | 0.107 | 0.146 | 0.092 | 0.101 | 0.153 | 0.158 | 0.483 | 0.137 | 0.120 | 0.146 |
| Ta | 1.063 | 1.080 | 1.032 | 0.975 | 1.289 | 1.761 | 1.739 | 1.788 | 1.736 | 1.802 | 1.809 | 1.765 | 1.759 | 1.423 | 1.754 | 1.795 | 1.755 |
| W | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.003 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.001 | 0.000 | 0.000 |
| Sn | 0.052 | 0.054 | 0.052 | 0.039 | 0.043 | 0.056 | 0.062 | 0.043 | 0.050 | 0.047 | 0.042 | 0.039 | 0.044 | 0.026 | 0.035 | 0.032 | 0.039 |
| Al |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.012 | 0.010 | 0.012 | 0.010 | 0.006 | 0.019 | 0.006 | 0.001 | 0.004 | 0.006 | 0.001 | 0.016 | 0.005 | 0.081 | 0.008 | 0.001 | 0.012 |
| Mn | 0.039 | 0.035 | 0.045 | 0.046 | 0.015 | 0.010 | 0.025 | 0.015 | 0.012 | 0.031 | 0.017 | 0.016 | 0.009 | 0.533 | 0.010 | 0.018 | 0.052 |
| Mg |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ca | 1.113 | 1.107 | 1.089 | 1.101 | 1.038 | 0.835 | 1.125 | 1.137 | 1.139 | 0.918 | 0.926 | 0.814 | 1.016 | 0.526 | 1.118 | 1.108 | 1.047 |
| Na | 0.407 | 0.572 | 0.631 | 0.642 | 0.669 | 0.655 | 0.832 | 0.836 | 0.838 | 0.674 | 0.591 | 0.495 | 0.722 | 0.361 | 0.861 | 0.908 | 0.838 |
| K |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Ba |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Pb | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.009 | 0.002 | 0.001 | 0.002 | 0.018 | 0.014 | 0.003 | 0.000 | 0.003 | 0.001 | 0.002 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.023 | 0.004 | 0.004 | 0.003 | 0.049 | 0.030 | 0.008 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sb | 0.488 | 0.461 | 0.477 | 0.497 | 0.210 | 0.037 | 0.048 | 0.034 | 0.044 | 0.025 | 0.022 | 0.045 | 0.039 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cs |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Y |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Si |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| F | 0.597 | 0.612 | 0.494 | 0.628 | 0.947 | 0.784 | 1.155 | 1.150 | 1.098 | 0.893 | 0.847 | 0.652 | 0.897 | 0.507 | 1.043 | 1.054 | 0.958 |
| OH* | 0.403 | 0.388 | 0.506 | 0.372 | 0.053 | 0.216 | 0.000 | 0.000 | 0.000 | 0.107 | 0.153 | 0.348 | 0.103 | 0.493 | 0.000 | 0.000 | 0.042 |
| Total | 5.062 | 5.186 | 5.255 | 5.297 | 4.939 | 4.587 | 5.198 | 5.178 | 5.139 | 4.722 | 4.602 | 4.397 | 4.793 | 4.503 | 5.041 | 5.094 | 4.948 |

Comments:K & M same grainP, Q & G same grain microlite replaces wodginite odd ?

antimonian microlite replaces wodginite

| | **Microlite-like (after ferrotapiolite)** | | | | | | | **Microlite** | | | | **Microlite** | | **Microlite** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Marko's pegmatite** | | | | | | | **Marko's pegmatite** | | | | **Marko's peg.** | | **Marko's pegmatite** | | | |
| | 94-44Z | | | | | | | 94-44ii | | | | 94-44iii(3) | | 94-44iii(3) | | | |
| | FA | FC | FD | FE | FG | FI | FJ | EF | EG | EI | EJ | AA | AC | AD | AE | AH | AA |
| Na2O | 1.97 | 2.20 | 0.65 | 1.30 | 2.09 | 1.04 | 1.79 | 5.08 | 3.12 | 3.83 | 5.18 | 5.06 | 4.42 | 5.28 | 5.43 | 5.57 | 5.26 |
| CaO | 7.08 | 8.86 | 2.48 | 5.03 | 9.22 | 3.58 | 10.85 | 12.55 | 12.70 | 11.98 | 12.74 | 9.89 | 8.93 | 10.61 | 10.23 | 10.78 | 9.21 |
| Al2O3 | | | | | | | | | | | | | | | | | |
| FeO | 6.26 | 3.22 | 12.04 | 9.00 | 2.65 | 11.72 | 1.90 | 0.02 | 0.68 | 0.05 | 0.01 | 0.02 | 0.07 | 0.02 | 0.06 | 0.07 | 0.03 |
| MnO | 0.00 | 0.09 | 0.00 | 0.00 | 0.06 | 0.00 | 0.02 | 0.14 | 0.27 | 0.17 | 0.18 | 0.06 | 0.05 | 0.05 | 0.05 | 0.07 | 0.05 |
| MgO | | | | | | | | | | | | | | | | | |
| TiO2 | 0.00 | 0.13 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.75 | 0.77 | 0.78 | 0.74 | 0.62 | 0.59 | 0.63 | 0.64 | 0.66 | 0.64 |
| Nb2O5 | 0.89 | 1.09 | 1.26 | 1.09 | 0.81 | 1.57 | 1.92 | 3.00 | 2.89 | 2.90 | 2.75 | 3.14 | 2.87 | 2.99 | 2.80 | 2.52 | 3.10 |
| Ta2O5 | 75.38 | 76.00 | 73.89 | 75.54 | 75.03 | 73.35 | 76.22 | 73.09 | 74.15 | 74.95 | 73.50 | 75.79 | 78.11 | 74.90 | 75.13 | 74.65 | 76.94 |
| SnO2 | 1.27 | 1.12 | 1.14 | 1.11 | 1.32 | 1.31 | 1.24 | 1.51 | 1.04 | 1.11 | 1.30 | 1.32 | 1.19 | 1.47 | 1.04 | 0.92 | 1.57 |
| WO3 | 0.37 | 0.38 | 0.44 | 0.63 | 0.29 | 0.22 | 0.73 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 |
| PbO | 0.00 | 0.00 | 0.77 | 0.00 | 0.00 | 0.21 | 0.00 | 0.36 | 0.23 | 0.09 | 0.23 | 0.12 | 0.09 | 0.17 | 0.05 | 0.05 | 0.07 |
| ThO2 | 0.19 | 0.38 | 0.00 | 0.56 | 0.00 | 0.00 | 0.45 | 0.06 | 0.05 | 0.04 | 0.03 | 0.07 | 0.02 | 0.04 | 0.07 | 0.04 | 0.01 |
| UO2 | 1.71 | 1.08 | 1.43 | 1.01 | 1.78 | 1.51 | 0.72 | 0.63 | 0.99 | 0.70 | 0.73 | 0.54 | 0.44 | 0.51 | 0.47 | 0.37 | 0.47 |
| Sb2O3 | 0.55 | 0.29 | 0.27 | 0.55 | 0.89 | 0.77 | 0.30 | 0.80 | 0.89 | 0.69 | 0.69 | 0.78 | 0.60 | 0.78 | 0.67 | 0.72 | 0.68 |
| Bi2O3 | 0.00 | 0.00 | 0.13 | 0.58 | 0.16 | 0.00 | 0.21 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.04 | 0.02 | 0.02 |
| Sc2O3 | 0.28 | 0.00 | 0.69 | 1.47 | 2.20 | 0.14 | 0.00 | 0.02 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 |
| Cs2O | 0.68 | 0.69 | 1.62 | 0.00 | 0.55 | 0.77 | 0.77 | | | | | | | | | | |
| BaO | | | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | | | | |
| F | 1.12 | 1.45 | 0.24 | 0.54 | 1.49 | 0.26 | 1.23 | 3.95 | 3.17 | 3.24 | 4.06 | 4.22 | 4.28 | 4.12 | 4.50 | 4.44 | 4.10 |
| H2O* | 2.35 | 2.01 | 3.18 | 3.01 | 2.00 | 3.18 | 2.33 | 0.00 | 0.40 | 0.36 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Subtotal | 100.09 | 98.99 | 100.23 | 101.40 | 100.53 | 99.61 | 100.66 | 101.96 | 101.36 | 100.95 | 102.16 | 101.63 | 101.68 | 101.57 | 101.18 | 100.89 | 102.17 |
| O=F | 0.47 | 0.61 | 0.10 | 0.23 | 0.63 | 0.11 | 0.52 | 1.66 | 1.33 | 1.36 | 1.71 | 1.77 | 1.80 | 1.73 | 1.89 | 1.87 | 1.73 |
| Total | 99.62 | 98.38 | 100.13 | 101.17 | 99.91 | 99.51 | 100.14 | 100.30 | 100.02 | 99.59 | 100.45 | 99.86 | 99.88 | 99.84 | 99.29 | 99.02 | 100.44 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | |
| Ti | 0.000 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.050 | 0.052 | 0.052 | 0.050 | 0.040 | 0.038 | 0.042 | 0.043 | 0.045 | 0.041 |
| Nb | 0.037 | 0.045 | 0.054 | 0.045 | 0.034 | 0.067 | 0.078 | 0.121 | 0.116 | 0.115 | 0.111 | 0.123 | 0.111 | 0.119 | 0.112 | 0.102 | 0.120 |
| Ta | 1.907 | 1.896 | 1.893 | 1.899 | 1.909 | 1.879 | 1.858 | 1.775 | 1.795 | 1.794 | 1.792 | 1.791 | 1.811 | 1.788 | 1.809 | 1.820 | 1.786 |
| W | 0.009 | 0.009 | 0.011 | 0.015 | 0.007 | 0.005 | 0.017 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sn | 0.047 | 0.041 | 0.043 | 0.041 | 0.049 | 0.049 | 0.044 | 0.054 | 0.037 | 0.039 | 0.046 | 0.046 | 0.040 | 0.051 | 0.037 | 0.033 | 0.053 |
| Al | | | | | | | | | | | | | | | | | |
| Fe | 0.487 | 0.247 | 0.948 | 0.696 | 0.207 | 0.923 | 0.142 | 0.001 | 0.051 | 0.004 | 0.001 | 0.001 | 0.005 | 0.001 | 0.004 | 0.005 | 0.002 |
| Mn | 0.000 | 0.007 | 0.000 | 0.000 | 0.005 | 0.000 | 0.002 | 0.011 | 0.020 | 0.013 | 0.014 | 0.004 | 0.004 | 0.004 | 0.004 | 0.005 | 0.004 |
| Mg | | | | | | | | | | | | | | | | | |
| Ca | 0.706 | 0.871 | 0.250 | 0.498 | 0.924 | 0.361 | 1.042 | 1.201 | 1.211 | 1.130 | 1.224 | 0.920 | 0.816 | 0.998 | 0.970 | 1.036 | 0.842 |
| Na | 0.356 | 0.392 | 0.118 | 0.232 | 0.378 | 0.189 | 0.310 | 0.879 | 0.538 | 0.654 | 0.901 | 0.852 | 0.731 | 0.899 | 0.932 | 0.968 | 0.870 |
| K | | | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | | | |
| Pb | 0.000 | 0.000 | 0.019 | 0.000 | 0.000 | 0.005 | 0.000 | 0.009 | 0.006 | 0.002 | 0.006 | 0.003 | 0.002 | 0.004 | 0.001 | 0.001 | 0.002 |
| Th | 0.004 | 0.008 | 0.000 | 0.012 | 0.000 | 0.000 | 0.009 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 |
| U | 0.035 | 0.022 | 0.030 | 0.021 | 0.037 | 0.032 | 0.014 | 0.013 | 0.020 | 0.014 | 0.015 | 0.010 | 0.008 | 0.010 | 0.009 | 0.007 | 0.009 |
| Sb | 0.021 | 0.011 | 0.011 | 0.021 | 0.034 | 0.030 | 0.011 | 0.029 | 0.033 | 0.025 | 0.026 | 0.028 | 0.021 | 0.028 | 0.024 | 0.027 | 0.024 |
| Bi | 0.000 | 0.000 | 0.003 | 0.014 | 0.004 | 0.000 | 0.005 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Cs | 0.027 | 0.027 | 0.065 | 0.000 | 0.022 | 0.031 | 0.029 | | | | | | | | | | |
| Sc | 0.022 | 0.000 | 0.056 | 0.118 | 0.179 | 0.012 | 0.000 | 0.002 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 |
| Y | | | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | | | | |
| F | 0.329 | 0.422 | 0.071 | 0.156 | 0.442 | 0.077 | 0.348 | 1.115 | 0.892 | 0.902 | 1.151 | 1.158 | 1.154 | 1.144 | 1.260 | 1.259 | 1.107 |
| OH* | 0.671 | 0.578 | 0.929 | 0.844 | 0.558 | 0.923 | 0.652 | 0.000 | 0.108 | 0.098 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Total | 4.659 | 4.584 | 4.501 | 4.612 | 4.791 | 4.582 | 4.565 | 5.261 | 4.880 | 4.844 | 5.337 | 4.980 | 4.741 | 5.089 | 5.207 | 5.310 | 4.862 |
| Comments: | core | core | rim | | rim | | | all same grain | | | | uniform mineral separate - all same grain | | | | | |
| | remnants of possible ferrotapiolite | | | | | | | microlite replaces wodginite | | | | | | | | | |

## Pyrochlore Group

| | **Uranmicrolite** | | **Uranmicrolite** | | **Microlite** | | | **Microlite** | | | | | **Microlite** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Pegmatite 5** | | **Pegmatite 5** | | **Pegmatite 5** | | | **Treelined Lake Complex** | | | | | **Pegmatite 7** | | |
| | 94-80D | | 94-80F | | 94-80I | | | 94-84E | | | | | 94-Peg 7B | | |
| | GJ | GK | ZD | ZE | QP | QQ | QR | EA | EB | EC | ED | EE | QB | WZ | XB |
| Na2O | 0.44 | 0.44 | 1.52 | 1.96 | 3.89 | 3.73 | 3.93 | 1.97 | 2.72 | 3.14 | 2.16 | 1.81 | 1.17 | 0.62 | 0.65 |
| CaO | 3.44 | 4.44 | 6.30 | 6.27 | 12.18 | 12.48 | 12.57 | 6.23 | 9.07 | 6.73 | 6.07 | 6.26 | 15.97 | 10.60 | 14.87 |
| Al2O3 | | | | | | | | | | | | | | 0.05 | 0.10 |
| FeO | 0.60 | 0.65 | 1.79 | 1.24 | 0.10 | 0.13 | 0.10 | 0.09 | 0.61 | 0.09 | 1.36 | 0.57 | 0.10 | 1.86 | 0.34 |
| MnO | 0.33 | 0.40 | 0.36 | 0.45 | 0.07 | 0.10 | 0.11 | 0.32 | 0.28 | 0.23 | 0.14 | 0.23 | 0.25 | 1.93 | 0.39 |
| MgO | | | | | | | | | | | | | | 0.02 | 0.00 |
| TiO2 | 0.39 | 0.44 | 0.49 | 0.34 | 1.90 | 1.81 | 1.62 | 0.14 | 0.16 | 0.18 | 0.13 | 0.15 | 0.82 | 1.09 | 2.16 |
| Nb2O5 | 1.76 | 1.90 | 1.65 | 1.46 | 5.35 | 5.78 | 5.58 | 4.66 | 4.57 | 4.70 | 4.21 | 4.76 | 7.64 | 36.98 | 13.61 |
| Ta2O5 | 67.61 | 66.00 | 63.93 | 65.29 | 68.37 | 68.01 | 69.30 | 74.14 | 70.33 | 72.68 | 68.80 | 71.33 | 66.64 | 40.52 | 60.68 |
| SnO2 | 0.16 | 0.32 | 0.90 | 1.03 | 2.37 | 2.60 | 2.53 | 0.71 | 0.49 | 0.74 | 0.51 | 0.58 | 3.60 | 1.81 | 3.34 |
| WO3 | 0.08 | 0.19 | 0.00 | 0.00 | 0.36 | 0.47 | 0.37 | 0.53 | 0.59 | 0.53 | 0.41 | 0.54 | 0.13 | 0.55 | 0.12 |
| PbO | 2.64 | 2.67 | 3.11 | 3.05 | 1.15 | 0.83 | 0.69 | 0.59 | 0.85 | 0.89 | 4.05 | 0.82 | 0.12 | 0.63 | 0.28 |
| ThO2 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 | 0.04 | 0.01 | 0.01 | 0.00 | 0.03 |
| UO2 | 16.61 | 16.36 | 13.65 | 13.24 | 0.20 | 0.10 | 0.04 | 1.76 | 1.74 | 1.72 | 1.59 | 1.72 | 0.41 | 0.72 | 0.55 |
| Sb2O3 | | | 0.78 | 0.67 | 2.48 | 2.53 | 1.90 | 1.46 | 2.19 | 1.75 | 1.68 | 1.63 | | 0.19 | 0.58 |
| Bi2O3 | | | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.01 | 0.00 | 0.05 | | 0.00 | 0.04 |
| Sc2O3 | | | 0.03 | 0.02 | 0.11 | 0.00 | 0.00 | 0.98 | 0.30 | 1.37 | 2.91 | 4.64 | | 0.17 | 0.00 |
| Cs2O | | | | | 0.00 | 0.09 | 0.04 | | | | | | | | |
| BaO | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | | |
| F | 0.36 | 1.65 | 1.07 | 1.06 | 3.00 | 2.84 | 3.10 | 1.14 | 1.60 | 1.77 | 1.38 | 1.47 | 2.18 | 0.92 | 1.94 |
| H2O* | 2.73 | 1.43 | 2.06 | 2.09 | 0.74 | 0.93 | 0.67 | 2.35 | 1.86 | 1.76 | 2.01 | 2.08 | 1.60 | 3.57 | 2.11 |
| Subtotal | 97.15 | 96.89 | 97.64 | 98.25 | 102.27 | 102.44 | 102.57 | 97.10 | 97.36 | 98.30 | 97.44 | 98.64 | 100.64 | 102.23 | 101.79 |
| O=F | 0.15 | 0.69 | 0.45 | 0.45 | 1.26 | 1.19 | 1.30 | 0.48 | 0.67 | 0.75 | 0.58 | 0.62 | 0.92 | 0.39 | 0.82 |
| Total | 97.00 | 96.20 | 97.19 | 97.81 | 101.01 | 101.25 | 101.27 | 96.62 | 96.69 | 97.55 | 96.86 | 98.02 | 99.73 | 101.84 | 100.98 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Ti | 0.030 | 0.034 | 0.039 | 0.027 | 0.122 | 0.115 | 0.103 | 0.009 | 0.011 | 0.012 | 0.009 | 0.010 | 0.052 | 0.056 | 0.126 |
| Nb | 0.081 | 0.089 | 0.079 | 0.069 | 0.206 | 0.221 | 0.213 | 0.185 | 0.191 | 0.189 | 0.181 | 0.195 | 0.292 | 1.134 | 0.478 |
| Ta | 1.880 | 1.858 | 1.844 | 1.861 | 1.584 | 1.566 | 1.591 | 1.769 | 1.766 | 1.760 | 1.780 | 1.761 | 1.532 | 0.748 | 1.281 |
| W | 0.002 | 0.005 | 0.000 | 0.000 | 0.008 | 0.010 | 0.008 | 0.012 | 0.014 | 0.012 | 0.010 | 0.013 | 0.003 | 0.010 | 0.002 |
| Sn | 0.007 | 0.013 | 0.038 | 0.043 | 0.080 | 0.088 | 0.085 | 0.025 | 0.018 | 0.026 | 0.019 | 0.021 | 0.121 | 0.049 | 0.103 |
| Al | | | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.009 |
| Fe | 0.051 | 0.056 | 0.159 | 0.109 | 0.007 | 0.009 | 0.007 | 0.007 | 0.047 | 0.007 | 0.108 | 0.043 | 0.007 | 0.106 | 0.022 |
| Mn | 0.029 | 0.035 | 0.032 | 0.040 | 0.005 | 0.007 | 0.008 | 0.024 | 0.022 | 0.017 | 0.011 | 0.018 | 0.018 | 0.111 | 0.026 |
| Mg | | | | | | | | | | | | | 0.000 | 0.002 | 0.000 |
| Ca | 0.377 | 0.493 | 0.716 | 0.704 | 1.111 | 1.131 | 1.137 | 0.586 | 0.897 | 0.642 | 0.619 | 0.609 | 1.446 | 0.771 | 1.237 |
| Na | 0.087 | 0.088 | 0.313 | 0.398 | 0.643 | 0.611 | 0.644 | 0.335 | 0.487 | 0.542 | 0.398 | 0.318 | 0.192 | 0.082 | 0.098 |
| K | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | |
| Pb | 0.073 | 0.074 | 0.089 | 0.086 | 0.026 | 0.019 | 0.016 | 0.014 | 0.021 | 0.021 | 0.104 | 0.020 | 0.003 | 0.012 | 0.006 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| U | 0.378 | 0.377 | 0.322 | 0.309 | 0.004 | 0.002 | 0.001 | 0.034 | 0.036 | 0.034 | 0.034 | 0.035 | 0.008 | 0.011 | 0.010 |
| Sb | 0.000 | 0.000 | 0.034 | 0.029 | 0.087 | 0.088 | 0.066 | 0.053 | 0.083 | 0.064 | 0.066 | 0.061 | | 0.005 | 0.019 |
| Bi | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | | 0.000 | 0.001 |
| Cs | | | | | 0.000 | 0.003 | 0.002 | | | | | | | | |
| Sc | 0.000 | 0.000 | 0.003 | 0.002 | 0.008 | 0.000 | 0.000 | 0.075 | 0.024 | 0.106 | 0.241 | 0.367 | | 0.010 | 0.000 |
| Y | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | | |
| F | 0.116 | 0.540 | 0.359 | 0.351 | 0.808 | 0.759 | 0.827 | 0.317 | 0.467 | 0.500 | 0.417 | 0.423 | 0.583 | 0.197 | 0.476 |
| OH* | 0.884 | 0.460 | 0.641 | 0.649 | 0.192 | 0.241 | 0.173 | 0.683 | 0.533 | 0.500 | 0.583 | 0.577 | 0.417 | 0.803 | 0.524 |
| Total | 3.995 | 4.123 | 4.667 | 4.679 | 4.891 | 4.872 | 4.881 | 4.127 | 4.617 | 4.434 | 4.582 | 4.471 | 4.674 | 4.108 | 4.418 |
| Comments: | | | | | inclusions/replacement<br>in/of ferrotantalite | | | analysed twice and checked for<br>additional elements | | | | | | | inclusion<br>in<br>cassiterite |

| | Microlite | | Microlite | | Microlite | | | Microlite | | | | | Yttropyrochlore | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Pegmatite 7 | | SW Beryl | | SW Beryl pegmatite | | | SW Beryl pegmatite | | | | | Big Whopper | | |
| | 94-Peg 7X | | 96-9 | | 96-9 | | | 96-25A | | | | | 96-29G | | |
| | NM | NR | FF | FG | FH | FK | FL | WG | WH | WI | WJ | WK | FA | FB | FG |
| Na2O | 0.96 | 2.04 | 1.30 | 1.29 | 1.20 | 1.97 | 1.98 | 0.79 | 0.80 | 0.81 | 1.01 | 0.87 | 0.00 | 0.00 | 0.00 |
| CaO | 13.73 | 11.03 | 15.48 | 15.65 | 15.48 | 15.37 | 15.24 | 16.14 | 16.39 | 16.77 | 16.68 | 17.32 | 0.59 | 0.58 | 0.62 |
| Al2O3 | 0.30 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.28 | 1.13 | 0.10 | 0.14 | 0.14 | 0.08 | 0.08 | 0.05 | 0.06 | 0.05 | 0.02 | 0.07 | 0.00 | 0.00 | 0.00 |
| MnO | 0.22 | 0.51 | 0.03 | 0.03 | 0.01 | 0.01 | 0.01 | 0.13 | 0.11 | 0.13 | 0.12 | 0.10 | 0.00 | 0.00 | 0.00 |
| MgO | 0.00 | 0.00 | | | | | | | | | | | | | |
| TiO2 | 1.13 | 1.80 | 0.97 | 0.99 | 0.94 | 1.39 | 1.40 | 0.61 | 0.62 | 0.75 | 0.71 | 0.85 | 0.06 | 0.09 | 0.08 |
| Nb2O5 | 6.45 | 6.69 | 4.57 | 4.57 | 4.75 | 5.80 | 6.06 | 8.41 | 9.09 | 12.28 | 12.80 | 13.79 | 37.40 | 36.44 | 35.67 |
| Ta2O5 | 63.75 | 65.20 | 74.30 | 74.26 | 75.23 | 71.15 | 71.08 | 67.17 | 66.72 | 63.17 | 62.43 | 60.19 | 10.64 | 12.79 | 12.89 |
| SnO2 | 5.07 | 4.59 | 0.66 | 0.66 | 0.63 | 1.20 | 1.26 | 2.44 | 2.52 | 2.67 | 3.20 | 3.40 | 0.00 | 0.00 | 0.00 |
| WO3 | 0.21 | 0.20 | 0.28 | 0.38 | 0.29 | 0.40 | 0.38 | 0.47 | 0.35 | 0.34 | 0.34 | 0.39 | 1.68 | 1.44 | 1.17 |
| PbO | 0.34 | 0.31 | 0.00 | 0.03 | 0.00 | 0.07 | 0.00 | 0.17 | 0.06 | 0.09 | 0.02 | 0.08 | 0.65 | 0.97 | 0.90 |
| ThO2 | 0.05 | 0.02 | 0.04 | 0.00 | 0.03 | 0.00 | 0.02 | 0.06 | 0.01 | 0.00 | 0.01 | 0.06 | 0.57 | 0.39 | 0.65 |
| UO2 | 0.66 | 1.16 | 0.05 | 0.02 | 0.06 | 0.02 | 0.01 | 0.40 | 0.32 | 0.21 | 0.00 | 0.06 | 2.05 | 2.18 | 2.14 |
| Sb2O3 | 3.82 | 0.54 | 0.00 | 0.00 | 0.00 | 0.03 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.06 | 0.00 | 0.00 | 0.10 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.13 | 0.12 | 0.00 | 0.00 | 0.08 | 0.00 |
| Cs2O | | | 0.07 | 0.05 | 0.02 | 0.09 | 0.09 | 0.10 | 0.01 | 0.06 | 0.08 | 0.05 | 0.00 | 0.05 | 0.00 |
| BaO | | | | | | | | | | | | | 0.00 | 0.00 | 0.00 |
| K2O | | | | | | | | | | | | | 0.15 | 0.03 | 0.19 |
| Y2O3 | | | | | | | | | | | | | 19.49 | 20.92 | 18.60 |
| SiO2 | | | | | | | | | | | | | | | |
| F | 2.02 | 2.23 | 2.35 | 2.34 | 2.38 | 2.52 | 2.54 | 1.47 | 1.61 | 1.67 | 2.02 | 1.83 | 0.13 | 0.26 | 0.38 |
| H2O* | 1.73 | 1.53 | 1.37 | 1.40 | 1.39 | 1.24 | 1.24 | 2.33 | 2.22 | 2.26 | 1.93 | 2.13 | 23.84 | 24.21 | 23.11 |
| Subtotal | 100.72 | 98.98 | 101.63 | 101.80 | 102.63 | 101.45 | 101.43 | 100.74 | 100.89 | 101.41 | 101.49 | 101.19 | 97.10 | 100.39 | 96.22 |
| O=F | 0.85 | 0.94 | 0.99 | 0.98 | 1.00 | 1.06 | 1.07 | 0.62 | 0.68 | 0.70 | 0.85 | 0.77 | 0.05 | 0.11 | 0.16 |
| Total | 99.87 | 98.05 | 100.64 | 100.82 | 101.62 | 100.38 | 100.36 | 100.13 | 100.21 | 100.71 | 100.64 | 100.41 | 97.04 | 100.29 | 96.06 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Ti | 0.072 | 0.113 | 0.063 | 0.064 | 0.060 | 0.088 | 0.089 | 0.039 | 0.039 | 0.046 | 0.043 | 0.052 | 0.004 | 0.006 | 0.006 |
| Nb | 0.248 | 0.252 | 0.177 | 0.177 | 0.182 | 0.222 | 0.231 | 0.322 | 0.345 | 0.454 | 0.469 | 0.505 | 1.668 | 1.616 | 1.613 |
| Ta | 1.473 | 1.478 | 1.732 | 1.728 | 1.731 | 1.640 | 1.630 | 1.547 | 1.524 | 1.406 | 1.377 | 1.326 | 0.285 | 0.341 | 0.351 |
| W | 0.005 | 0.004 | 0.006 | 0.008 | 0.006 | 0.009 | 0.008 | 0.010 | 0.008 | 0.007 | 0.007 | 0.008 | 0.043 | 0.037 | 0.030 |
| Sn | 0.172 | 0.153 | 0.022 | 0.023 | 0.021 | 0.041 | 0.042 | 0.082 | 0.084 | 0.087 | 0.103 | 0.110 | 0.000 | 0.000 | 0.000 |
| Al | 0.030 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.020 | 0.079 | 0.007 | 0.010 | 0.010 | 0.006 | 0.006 | 0.004 | 0.004 | 0.003 | 0.002 | 0.004 | 0.000 | 0.000 | 0.000 |
| Mn | 0.016 | 0.036 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.009 | 0.008 | 0.009 | 0.008 | 0.007 | 0.000 | 0.000 | 0.000 |
| Mg | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ca | 1.250 | 0.985 | 1.422 | 1.435 | 1.404 | 1.396 | 1.377 | 1.464 | 1.474 | 1.470 | 1.449 | 1.503 | 0.062 | 0.060 | 0.066 |
| Na | 0.158 | 0.330 | 0.217 | 0.215 | 0.196 | 0.324 | 0.324 | 0.130 | 0.130 | 0.129 | 0.159 | 0.137 | 0.000 | 0.000 | 0.000 |
| K | | | | | | | | | | | | | 0.019 | 0.003 | 0.025 |
| Ba | | | | | | | | | | | | | 0.000 | 0.000 | 0.000 |
| Pb | 0.008 | 0.007 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.004 | 0.001 | 0.002 | 0.000 | 0.002 | 0.017 | 0.026 | 0.024 |
| Th | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.013 | 0.009 | 0.015 |
| U | 0.012 | 0.022 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.007 | 0.006 | 0.004 | 0.000 | 0.001 | 0.045 | 0.048 | 0.048 |
| Sb | 0.134 | 0.019 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cs | | | 0.003 | 0.002 | 0.001 | 0.003 | 0.003 | 0.004 | 0.000 | 0.002 | 0.003 | 0.002 | 0.000 | 0.002 | 0.000 |
| Sc | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.000 | 0.000 | 0.000 | 0.000 | 0.010 | 0.008 | 0.000 | 0.000 | 0.006 | 0.000 |
| Y | | | | | | | | | | | | | 1.023 | 1.092 | 0.990 |
| Si | | | | | | | | | | | | | | | |
| F | 0.543 | 0.588 | 0.638 | 0.633 | 0.638 | 0.676 | 0.677 | 0.393 | 0.427 | 0.431 | 0.518 | 0.470 | 0.039 | 0.079 | 0.121 |
| OH* | 0.457 | 0.412 | 0.362 | 0.367 | 0.362 | 0.324 | 0.323 | 0.607 | 0.573 | 0.569 | 0.482 | 0.530 | 6.961 | 6.921 | 6.879 |
| Total | 4.599 | 4.477 | 4.653 | 4.664 | 4.621 | 4.735 | 4.712 | 4.623 | 4.625 | 4.629 | 4.630 | 4.657 | 10.180 | 10.247 | 10.168 |
| | | | | | | | | | | | | | calculated (F+OH) = 7 | | |
| Comments: | | primary | | | | | | | | | | | | | |
| | | | | | | | | | | | | | Original | | |

| | FC | FD | FF | FE | FH | SA | SB | SE | SF | SL | TR15 | TR20 | TR21 | TR23 | TR33 | TR40 | TR41 | TR42 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Yttrian pyrochlore** | | | | | **Microlite** | | | | | | | | | | | | |
| | **Big Whopper pegmatite** | | | | | **Marko's pegmatite** | | | | | | | | | | | | |
| | 96-29G | | | | | 96-AT1 | | | | | | | | | | | | |
| Na2O | 0.12 | 0.08 | 0.20 | 0.18 | 0.09 | 0.77 | 0.75 | 0.76 | 0.75 | 0.77 | 0.82 | 0.76 | 0.78 | 0.69 | 0.65 | 0.59 | 0.65 | 0.54 |
| CaO | 6.90 | 7.16 | 6.30 | 5.90 | 5.96 | 15.87 | 15.77 | 15.95 | 15.88 | 15.86 | 15.72 | 15.92 | 15.91 | 15.18 | 13.65 | 16.20 | 15.71 | 16.39 |
| Al2O3 | 0.77 | 1.02 | 0.72 | 0.69 | 0.79 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.05 | 0.00 |
| FeO | 0.81 | 0.77 | 1.00 | 1.07 | 0.74 | 0.04 | 0.06 | 0.08 | 0.10 | 0.09 | 0.23 | 0.11 | 0.09 | 0.14 | 0.29 | 0.16 | 0.17 | 0.07 |
| MnO | 1.10 | 1.33 | 1.06 | 1.02 | 1.05 | 0.16 | 0.15 | 0.16 | 0.15 | 0.16 | 0.18 | 0.20 | 0.17 | 0.20 | 0.21 | 0.22 | 0.22 | 0.21 |
| MgO | | | | | | | | | | | | | | | | | | |
| TiO2 | 0.00 | 0.00 | 0.07 | 0.07 | 0.12 | 1.33 | 1.31 | 1.40 | 1.45 | 1.38 | 2.11 | 1.71 | 1.63 | 1.54 | 2.50 | 2.26 | 2.93 | 1.82 |
| Nb2O5 | 44.33 | 41.08 | 43.99 | 43.19 | 42.39 | 7.18 | 7.36 | 6.81 | 7.27 | 7.68 | 13.05 | 10.78 | 9.37 | 8.30 | 13.00 | 13.80 | 11.44 | 11.61 |
| Ta2O5 | 12.95 | 15.03 | 12.56 | 12.96 | 14.65 | 69.09 | 68.62 | 69.00 | 67.56 | 67.21 | 56.16 | 60.24 | 61.82 | 63.34 | 56.81 | 55.08 | 55.44 | 59.43 |
| SnO2 | 0.07 | 0.12 | 0.06 | 0.10 | 0.07 | 1.89 | 1.89 | 1.83 | 1.97 | 1.92 | 3.19 | 2.92 | 2.93 | 2.98 | 3.35 | 3.33 | 3.64 | 2.82 |
| WO3 | 1.81 | 1.70 | 1.91 | 1.81 | 1.61 | 0.37 | 0.35 | 0.33 | 0.33 | 0.42 | 0.49 | 0.42 | 0.36 | 0.38 | 0.45 | 0.46 | 0.48 | 0.43 |
| PbO | 0.37 | 0.40 | 0.37 | 0.49 | 0.38 | 0.16 | 0.08 | 0.14 | 0.10 | 0.10 | 0.09 | 0.12 | 0.14 | 0.17 | 0.16 | 0.21 | 0.26 | 0.04 |
| ThO2 | 0.62 | 1.03 | 0.77 | 0.72 | 0.57 | 0.02 | 0.05 | 0.07 | 0.06 | 0.06 | 0.03 | 0.03 | 0.01 | 0.02 | 0.15 | 0.06 | 0.13 | 0.04 |
| UO2 | 2.00 | 1.91 | 2.85 | 2.51 | 2.61 | 0.52 | 0.46 | 0.39 | 0.48 | 0.45 | 0.38 | 0.41 | 0.38 | 0.39 | 0.35 | 0.47 | 0.46 | 0.43 |
| Sb2O3 | 0.01 | 0.02 | 0.00 | 0.00 | 0.01 | 1.17 | 1.20 | 1.23 | 1.44 | 1.35 | 2.88 | 1.98 | 1.63 | 1.70 | 3.70 | 3.23 | 4.75 | 2.18 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 |
| Sc2O3 | 0.27 | 0.10 | 0.00 | 0.00 | 0.11 | 0.00 | 0.19 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.09 | 0.04 | 0.00 | 0.06 | 0.05 |
| Cs2O | 0.02 | 0.06 | 0.00 | 0.02 | 0.00 | 0.07 | 0.06 | 0.05 | 0.09 | 0.11 | 0.05 | 0.00 | 0.10 | 0.00 | 0.01 | 0.02 | 0.03 | 0.00 |
| BaO | 0.06 | 0.00 | 0.01 | 0.00 | 0.00 | | | | | | 0.00 | 0.03 | 0.05 | 0.04 | 0.00 | 0.04 | 0.00 | 0.03 |
| K2O | 0.22 | 0.00 | 0.14 | 0.07 | 0.00 | | | | | | 0.00 | 0.06 | 0.00 | 0.00 | 0.07 | 0.00 | 0.05 | 0.00 |
| Y2O3 | 5.15 | 4.28 | 4.79 | 5.69 | 5.58 | | | | | | 0.01 | 0.00 | 0.00 | 0.00 | 0.12 | 0.11 | 0.05 | 0.00 |
| SiO2 | 4.67 | 6.17 | 4.03 | 3.50 | 4.46 | | | | | | | | | | | | | |
| F | 0.24 | 0.26 | 0.18 | 0.15 | 0.14 | 1.80 | 1.79 | 1.85 | 1.66 | 1.74 | 1.44 | 1.62 | 1.56 | 1.32 | 1.45 | 1.29 | 1.26 | 1.23 |
| H2O* | 16.95 | 17.05 | 16.51 | 16.20 | 16.59 | 2.04 | 2.04 | 1.96 | 2.15 | 2.07 | 2.46 | 2.22 | 2.23 | 2.45 | 2.47 | 2.67 | 2.66 | 2.66 |
| | | | | | | | | | | | | | | | | | | |
| Subtotal | 99.44 | 99.54 | 97.51 | 96.34 | 97.91 | 102.51 | 102.13 | 102.02 | 101.45 | 101.37 | 99.31 | 99.54 | 99.15 | 98.93 | 99.43 | 100.17 | 100.44 | 99.99 |
| O=F | 0.10 | 0.11 | 0.07 | 0.06 | 0.06 | 0.76 | 0.75 | 0.78 | 0.70 | 0.73 | 0.61 | 0.68 | 0.66 | 0.56 | 0.61 | 0.54 | 0.53 | 0.52 |
| Total | 99.34 | 99.44 | 97.44 | 96.28 | 97.85 | 101.75 | 101.37 | 101.24 | 100.75 | 100.64 | 98.71 | 98.86 | 98.49 | 98.38 | 98.82 | 99.63 | 99.91 | 99.47 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | | |
| Ti | 0.000 | 0.000 | 0.004 | 0.004 | 0.007 | 0.084 | 0.083 | 0.089 | 0.092 | 0.088 | 0.132 | 0.108 | 0.104 | 0.099 | 0.152 | 0.139 | 0.183 | 0.114 |
| Nb | 1.606 | 1.526 | 1.609 | 1.598 | 1.557 | 0.272 | 0.279 | 0.260 | 0.278 | 0.293 | 0.488 | 0.409 | 0.360 | 0.320 | 0.476 | 0.512 | 0.430 | 0.437 |
| Ta | 0.282 | 0.336 | 0.276 | 0.289 | 0.324 | 1.573 | 1.567 | 1.583 | 1.556 | 1.545 | 1.264 | 1.376 | 1.429 | 1.471 | 1.252 | 1.230 | 1.252 | 1.346 |
| W | 0.038 | 0.036 | 0.040 | 0.038 | 0.034 | 0.008 | 0.008 | 0.007 | 0.007 | 0.009 | 0.010 | 0.009 | 0.008 | 0.008 | 0.010 | 0.010 | 0.010 | 0.009 |
| Sn | 0.002 | 0.004 | 0.002 | 0.003 | 0.002 | 0.063 | 0.063 | 0.062 | 0.066 | 0.065 | 0.105 | 0.098 | 0.099 | 0.102 | 0.108 | 0.109 | 0.120 | 0.094 |
| Al | 0.073 | 0.098 | 0.068 | 0.067 | 0.075 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.005 | 0.000 |
| Fe | 0.054 | 0.053 | 0.068 | 0.073 | 0.050 | 0.003 | 0.004 | 0.006 | 0.007 | 0.007 | 0.016 | 0.008 | 0.006 | 0.010 | 0.019 | 0.011 | 0.012 | 0.005 |
| Mn | 0.075 | 0.093 | 0.073 | 0.071 | 0.072 | 0.011 | 0.011 | 0.011 | 0.011 | 0.011 | 0.013 | 0.014 | 0.012 | 0.014 | 0.014 | 0.015 | 0.015 | 0.015 |
| Mg | | | | | | | | | | | | | | | | | | |
| Ca | 0.592 | 0.631 | 0.546 | 0.517 | 0.519 | 1.424 | 1.419 | 1.441 | 1.441 | 1.437 | 1.395 | 1.432 | 1.449 | 1.389 | 1.185 | 1.425 | 1.397 | 1.463 |
| Na | 0.019 | 0.013 | 0.032 | 0.028 | 0.014 | 0.125 | 0.122 | 0.124 | 0.124 | 0.126 | 0.132 | 0.123 | 0.128 | 0.115 | 0.101 | 0.094 | 0.105 | 0.088 |
| K | 0.022 | 0.000 | 0.014 | 0.007 | 0.000 | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ba | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Pb | 0.008 | 0.009 | 0.008 | 0.011 | 0.008 | 0.004 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.003 | 0.003 | 0.004 | 0.004 | 0.005 | 0.006 | 0.001 |
| Th | 0.011 | 0.019 | 0.014 | 0.013 | 0.011 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.003 | 0.001 | 0.002 | 0.001 |
| U | 0.036 | 0.035 | 0.051 | 0.046 | 0.047 | 0.010 | 0.009 | 0.007 | 0.009 | 0.008 | 0.007 | 0.008 | 0.007 | 0.007 | 0.006 | 0.009 | 0.008 | 0.008 |
| Sb | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.040 | 0.042 | 0.043 | 0.050 | 0.047 | 0.098 | 0.068 | 0.057 | 0.060 | 0.124 | 0.109 | 0.163 | 0.075 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cs | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.002 | 0.002 | 0.002 | 0.003 | 0.004 | 0.002 | 0.000 | 0.003 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| Sc | 0.019 | 0.007 | 0.000 | 0.000 | 0.008 | 0.000 | 0.014 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.003 | 0.000 | 0.004 | 0.004 |
| Y | 0.220 | 0.187 | 0.206 | 0.248 | 0.241 | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.005 | 0.002 | 0.000 |
| Si | 0.374 | 0.507 | 0.326 | 0.287 | 0.362 | | | | | | | | | | | | | |
| F | 0.060 | 0.066 | 0.045 | 0.040 | 0.037 | 0.477 | 0.476 | 0.493 | 0.443 | 0.465 | 0.376 | 0.431 | 0.419 | 0.356 | 0.371 | 0.334 | 0.330 | 0.324 |
| OH* | 3.940 | 3.934 | 3.955 | 3.960 | 3.963 | 0.523 | 0.524 | 0.507 | 0.557 | 0.535 | 0.624 | 0.569 | 0.581 | 0.644 | 0.629 | 0.666 | 0.670 | 0.676 |
| Total | 7.433 | 7.556 | 7.339 | 7.302 | 7.333 | 4.621 | 4.624 | 4.639 | 4.649 | 4.643 | 4.665 | 4.657 | 4.666 | 4.607 | 4.465 | 4.674 | 4.716 | 4.658 |

calculated (F+OH) = 4

Comments:

Replacement

All from same grain - microlite replaces ? columbite

## Pyrochlore Group

| | **Stibiomicrolite** | | | | | | | | | **Stibiobetafite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Marko's pegmatite** | | | | | | | | | **Marko's pegmatite** | | | | | |
| | 96-AT1 | | | | | | | | | 96-AT1 | | | | | |
| | SH | SK | SN | TR16 | TR17 | TR18 | TR31 | TR32 | TR34 | TR1 | TR2 | TR4 | TR5 | TE | TF |
| Na2O | 0.41 | 0.35 | 0.44 | 0.49 | 0.50 | 0.42 | 0.26 | 0.33 | 0.40 | 0.58 | 0.43 | 0.35 | 0.05 | 0.59 | 0.58 |
| CaO | 14.25 | 14.27 | 14.37 | 13.92 | 13.93 | 13.02 | 4.89 | 11.98 | 13.75 | 9.85 | 7.87 | 10.41 | 10.83 | 9.42 | 9.32 |
| Al2O3 | 0.31 | 0.33 | 0.30 | 0.29 | 0.31 | 0.32 | 0.18 | 0.26 | 0.26 | 0.21 | 0.16 | 0.22 | 0.64 | 0.22 | 0.22 |
| FeO | 0.61 | 0.51 | 0.44 | 0.52 | 0.52 | 0.50 | 1.01 | 0.52 | 0.52 | 1.16 | 0.84 | 0.79 | 0.45 | 1.51 | 1.47 |
| MnO | 0.31 | 0.27 | 0.24 | 0.27 | 0.26 | 0.25 | 0.27 | 0.25 | 0.25 | 0.32 | 0.42 | 0.44 | 0.64 | 0.32 | 0.29 |
| MgO | | | | | | | | | | | | | | | |
| TiO2 | 5.71 | 6.05 | 5.77 | 5.94 | 5.66 | 5.74 | 5.11 | 5.81 | 6.38 | 24.46 | 23.62 | 24.63 | 19.52 | 26.19 | 26.22 |
| Nb2O5 | 10.17 | 10.01 | 9.65 | 11.06 | 11.33 | 10.90 | 10.93 | 6.64 | 11.02 | 11.05 | 11.50 | 12.67 | 10.20 | 12.08 | 12.20 |
| Ta2O5 | 49.56 | 48.33 | 50.60 | 46.48 | 46.84 | 47.46 | 54.71 | 47.05 | 46.41 | 20.06 | 20.20 | 17.35 | 20.25 | 19.95 | 19.90 |
| SnO2 | 3.50 | 3.67 | 3.40 | 5.11 | 5.23 | 5.15 | 4.80 | 3.70 | 5.17 | 3.77 | 3.71 | 4.05 | 4.37 | 3.17 | 3.15 |
| WO3 | 0.40 | 0.44 | 0.41 | 0.33 | 0.40 | 0.39 | 0.43 | 0.30 | 0.36 | 1.69 | 1.65 | 1.53 | 1.18 | 1.80 | 1.91 |
| PbO | 0.11 | 0.21 | 0.18 | 0.17 | 0.11 | 0.21 | 0.13 | 0.14 | 0.17 | 0.19 | 0.12 | 0.13 | 0.15 | 0.12 | 0.14 |
| ThO2 | 0.12 | 0.07 | 0.11 | 0.10 | 0.00 | 0.17 | 0.17 | 0.12 | 0.13 | 0.14 | 0.12 | 0.14 | 0.00 | 0.21 | 0.21 |
| UO2 | 0.37 | 0.32 | 0.41 | 0.37 | 0.36 | 0.44 | 0.35 | 0.36 | 0.40 | 0.13 | 0.04 | 0.06 | 0.05 | 0.15 | 0.10 |
| Sb2O3 | 11.65 | 12.08 | 11.25 | 11.46 | 11.04 | 11.17 | 9.54 | 8.63 | 11.91 | 19.96 | 22.46 | 20.89 | 25.34 | 16.75 | 16.73 |
| Bi2O3 | 0.00 | 0.00 | 0.04 | 0.00 | 0.02 | 0.00 | 0.04 | 0.00 | 0.01 | 0.05 | 0.05 | 0.06 | 0.02 | 0.07 | 0.04 |
| Sc2O3 | 0.00 | 0.01 | 0.04 | 0.13 | 0.07 | 0.06 | 2.11 | 0.17 | 0.10 | 0.81 | 1.59 | 0.68 | 0.33 | 1.37 | 1.49 |
| Cs2O | 0.01 | 0.00 | 0.05 | 0.05 | 0.00 | 0.02 | 0.00 | 0.00 | 0.05 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 |
| BaO | | | | 0.04 | 0.04 | 0.10 | 0.81 | 0.13 | 0.05 | 0.32 | 0.67 | 0.33 | 0.15 | 0.60 | 0.61 |
| K2O | | | | 0.00 | 0.00 | 0.00 | 0.05 | 0.11 | 0.07 | 0.00 | 0.12 | 0.19 | 0.15 | 0.27 | 0.04 |
| Y2O3 | | | | 0.43 | 0.43 | 0.44 | 0.37 | 0.30 | 0.52 | 1.00 | 1.17 | 1.10 | 1.16 | 0.89 | 0.96 |
| SiO2 | | | | | | | | | | | | | | | |
| F | 0.80 | 0.73 | 0.93 | 0.94 | 0.99 | 0.97 | 0.20 | 0.60 | 0.78 | 0.61 | 0.35 | 0.40 | 0.11 | 0.76 | 0.75 |
| H2O* | 3.21 | 3.28 | 3.08 | 3.10 | 3.05 | 3.04 | 3.70 | 2.97 | 3.31 | 4.14 | 4.36 | 4.39 | 4.38 | 4.12 | 4.13 |
| Subtotal | 101.50 | 100.92 | 101.69 | 101.21 | 101.09 | 100.73 | 100.04 | 90.35 | 102.02 | 100.48 | 101.49 | 100.80 | 99.96 | 100.55 | 100.48 |
| O=F | 0.34 | 0.31 | 0.39 | 0.39 | 0.42 | 0.41 | 0.08 | 0.25 | 0.33 | 0.25 | 0.15 | 0.17 | 0.05 | 0.32 | 0.32 |
| Total | 101.16 | 100.61 | 101.30 | 100.81 | 100.67 | 100.32 | 99.95 | 90.10 | 101.69 | 100.23 | 101.34 | 100.63 | 99.91 | 100.23 | 100.16 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Ti | 0.354 | 0.376 | 0.357 | 0.363 | 0.345 | 0.350 | 0.297 | 0.397 | 0.386 | 1.185 | 1.163 | 1.186 | 1.064 | 1.209 | 1.208 |
| Nb | 0.379 | 0.374 | 0.359 | 0.407 | 0.415 | 0.399 | 0.382 | 0.273 | 0.401 | 0.322 | 0.340 | 0.367 | 0.334 | 0.335 | 0.338 |
| Ta | 1.112 | 1.087 | 1.134 | 1.029 | 1.033 | 1.046 | 1.149 | 1.162 | 1.015 | 0.352 | 0.360 | 0.302 | 0.399 | 0.333 | 0.331 |
| W | 0.008 | 0.009 | 0.009 | 0.007 | 0.008 | 0.008 | 0.009 | 0.007 | 0.007 | 0.028 | 0.028 | 0.025 | 0.022 | 0.029 | 0.030 |
| Sn | 0.115 | 0.121 | 0.112 | 0.166 | 0.169 | 0.166 | 0.148 | 0.134 | 0.166 | 0.097 | 0.097 | 0.103 | 0.126 | 0.078 | 0.077 |
| Al | 0.030 | 0.032 | 0.029 | 0.028 | 0.029 | 0.030 | 0.017 | 0.027 | 0.025 | 0.016 | 0.012 | 0.016 | 0.054 | 0.016 | 0.016 |
| Fe | 0.042 | 0.035 | 0.031 | 0.036 | 0.035 | 0.034 | 0.065 | 0.039 | 0.035 | 0.063 | 0.046 | 0.042 | 0.027 | 0.078 | 0.075 |
| Mn | 0.021 | 0.019 | 0.017 | 0.019 | 0.018 | 0.017 | 0.017 | 0.019 | 0.017 | 0.018 | 0.023 | 0.024 | 0.039 | 0.016 | 0.015 |
| Mg | | | | | | | | | | | | | | | |
| Ca | 1.260 | 1.265 | 1.268 | 1.214 | 1.210 | 1.130 | 0.404 | 1.166 | 1.185 | 0.680 | 0.552 | 0.714 | 0.841 | 0.619 | 0.611 |
| Na | 0.065 | 0.056 | 0.070 | 0.077 | 0.078 | 0.066 | 0.039 | 0.058 | 0.063 | 0.072 | 0.055 | 0.044 | 0.007 | 0.070 | 0.069 |
| K | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Ba | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Pb | 0.002 | 0.005 | 0.004 | 0.004 | 0.002 | 0.005 | 0.003 | 0.004 | 0.004 | 0.003 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 |
| Th | 0.002 | 0.001 | 0.002 | 0.002 | 0.000 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.000 | 0.003 | 0.003 |
| U | 0.007 | 0.006 | 0.007 | 0.007 | 0.006 | 0.008 | 0.006 | 0.007 | 0.007 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 |
| Sb | 0.396 | 0.412 | 0.382 | 0.385 | 0.369 | 0.373 | 0.304 | 0.323 | 0.395 | 0.530 | 0.606 | 0.551 | 0.757 | 0.424 | 0.422 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 |
| Cs | 0.000 | 0.000 | 0.002 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 |
| Sc | 0.000 | 0.001 | 0.003 | 0.009 | 0.005 | 0.004 | 0.142 | 0.013 | 0.007 | 0.046 | 0.091 | 0.038 | 0.021 | 0.073 | 0.079 |
| Y | 0.000 | 0.000 | 0.000 | 0.019 | 0.019 | 0.019 | 0.015 | 0.014 | 0.022 | 0.034 | 0.041 | 0.038 | 0.045 | 0.029 | 0.031 |
| Si | | | | | | | | | | | | | | | |
| F | 0.209 | 0.191 | 0.242 | 0.241 | 0.254 | 0.249 | 0.049 | 0.173 | 0.197 | 0.123 | 0.073 | 0.082 | 0.026 | 0.147 | 0.146 |
| OH* | 0.791 | 0.809 | 0.758 | 0.759 | 0.746 | 0.751 | 0.951 | 0.827 | 0.803 | 0.877 | 0.927 | 0.918 | 0.974 | 0.853 | 0.854 |
| Total | 4.797 | 4.801 | 4.786 | 4.772 | 4.744 | 4.659 | 4.000 | 4.646 | 4.739 | 4.451 | 4.420 | 4.457 | 4.742 | 4.318 | 4.311 |

Comments replaces microlite

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | Sb/U | | | |
| | Microlite | | | Microlite | | Microlite | | Microlite | | Microlite | |
| | Marko's pegmatite | | | Marko's peg. | | Marko's peg. | | Marko's peg. | | Marko's peg. | |
| | 96-AT3 | | | 96-AT4 | | 96-AT5 | | 96-AT6 | | 96-AT7 | |
| | AH | AI | AJ | NG | NH | NA | NB | CD | CJ | DF | DL |
| Na2O | 0.96 | 1.28 | 0.95 | 2.08 | 1.82 | 3.71 | 2.68 | 0.77 | 2.04 | 0.97 | 1.18 |
| CaO | 15.01 | 14.59 | 13.77 | 13.45 | 11.16 | 13.86 | 12.60 | 12.29 | 10.39 | 16.26 | 14.61 |
| Al2O3 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.15 | 0.00 | 0.00 |
| FeO | 0.27 | 0.61 | 0.37 | 0.41 | 1.68 | 0.01 | 0.17 | 0.82 | 1.97 | 0.33 | 0.25 |
| MnO | 0.36 | 0.82 | 0.50 | 0.21 | 1.52 | 0.00 | 0.06 | 0.40 | 0.14 | 0.27 | 0.28 |
| MgO | | | | | | | | | | | |
| TiO2 | 2.62 | 3.51 | 2.50 | 3.52 | 3.17 | 2.96 | 2.18 | 8.53 | 10.89 | 5.30 | 5.42 |
| Nb2O5 | 6.33 | 7.56 | 7.12 | 9.17 | 9.98 | 8.10 | 5.43 | 13.52 | 12.97 | 19.17 | 19.30 |
| Ta2O5 | 67.58 | 66.25 | 63.50 | 64.00 | 64.52 | 67.18 | 70.37 | 44.67 | 38.47 | 47.21 | 47.86 |
| SnO2 | 1.15 | 2.22 | 5.80 | 1.47 | 2.24 | 0.90 | 2.04 | 2.16 | 2.02 | 1.77 | 1.76 |
| WO3 | 0.25 | 0.18 | 0.23 | 0.35 | 0.26 | 0.30 | 0.29 | 0.75 | 0.70 | 0.84 | 0.83 |
| PbO | 0.00 | 0.00 | 0.00 | 0.06 | 0.15 | 0.00 | 0.00 | 1.37 | 1.16 | 0.61 | 0.54 |
| ThO2 | 0.06 | 0.00 | 0.00 | 0.01 | 0.00 | 0.04 | 0.00 | 0.16 | 0.32 | 0.11 | 0.07 |
| UO2 | 0.11 | 0.04 | 0.03 | 0.51 | 0.24 | 0.08 | 0.20 | 7.11 | 5.70 | 1.28 | 1.20 |
| Sb2O3 | 2.37 | 1.83 | 1.58 | 1.72 | 0.20 | 1.14 | 0.79 | 4.91 | 10.50 | 4.37 | 4.64 |
| Bi2O3 | 0.07 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.02 | 0.05 | 0.03 | 0.00 |
| Sc2O3 | 0.00 | 0.09 | 0.15 | 0.00 | 0.19 | 0.31 | 0.14 | 0.40 | 1.94 | 0.25 | 0.12 |
| Cs2O | 0.03 | 0.18 | 0.12 | 0.14 | 0.04 | 0.04 | 0.06 | 0.00 | 0.00 | 0.05 | 0.00 |
| BaO | | | | | | | | | | | |
| K2O | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | |
| F | 1.63 | 1.97 | 1.79 | 2.25 | 1.69 | 2.85 | 2.50 | 1.11 | 1.75 | 1.58 | 1.75 |
| H2O* | 2.19 | 2.01 | 2.10 | 1.69 | 2.29 | 1.07 | 1.31 | 3.02 | 2.46 | 2.69 | 2.50 |
| Subtotal | 101.04 | 103.14 | 100.50 | 101.03 | 101.15 | 102.55 | 100.83 | 102.01 | 103.62 | 103.09 | 102.32 |
| O=F | 0.69 | 0.83 | 0.75 | 0.95 | 0.71 | 1.20 | 1.05 | 0.47 | 0.74 | 0.66 | 0.74 |
| Total | 100.35 | 102.31 | 99.75 | 100.09 | 100.44 | 101.35 | 99.78 | 101.54 | 102.88 | 102.42 | 101.58 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Ti | 0.166 | 0.211 | 0.152 | 0.213 | 0.188 | 0.181 | 0.136 | 0.498 | 0.638 | 0.302 | 0.305 |
| Nb | 0.241 | 0.273 | 0.260 | 0.333 | 0.355 | 0.298 | 0.203 | 0.475 | 0.457 | 0.656 | 0.653 |
| Ta | 1.546 | 1.441 | 1.396 | 1.399 | 1.381 | 1.486 | 1.587 | 0.943 | 0.815 | 0.972 | 0.974 |
| W | 0.005 | 0.004 | 0.005 | 0.007 | 0.005 | 0.006 | 0.006 | 0.015 | 0.014 | 0.016 | 0.016 |
| Sn | 0.039 | 0.071 | 0.187 | 0.047 | 0.070 | 0.029 | 0.068 | 0.067 | 0.063 | 0.054 | 0.053 |
| Al | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.014 | 0.000 | 0.000 |
| Fe | 0.019 | 0.041 | 0.025 | 0.028 | 0.110 | 0.001 | 0.012 | 0.053 | 0.128 | 0.021 | 0.016 |
| Mn | 0.026 | 0.055 | 0.034 | 0.014 | 0.101 | 0.000 | 0.004 | 0.027 | 0.009 | 0.018 | 0.018 |
| Mg | | | | | | | | | | | |
| Ca | 1.353 | 1.251 | 1.192 | 1.159 | 0.942 | 1.208 | 1.119 | 1.022 | 0.867 | 1.319 | 1.171 |
| Na | 0.157 | 0.198 | 0.149 | 0.325 | 0.278 | 0.585 | 0.431 | 0.115 | 0.308 | 0.142 | 0.171 |
| K | | | | | | | | | | | |
| Ba | | | | | | | | | | | |
| Pb | 0.000 | 0.000 | 0.000 | 0.001 | 0.003 | 0.000 | 0.000 | 0.029 | 0.024 | 0.012 | 0.011 |
| Th | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.006 | 0.002 | 0.001 |
| U | 0.002 | 0.001 | 0.000 | 0.009 | 0.004 | 0.001 | 0.004 | 0.123 | 0.099 | 0.022 | 0.020 |
| Sb | 0.082 | 0.060 | 0.053 | 0.057 | 0.007 | 0.038 | 0.027 | 0.157 | 0.337 | 0.136 | 0.143 |
| Bi | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| Cs | 0.001 | 0.006 | 0.004 | 0.005 | 0.001 | 0.001 | 0.002 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sc | 0.000 | 0.006 | 0.011 | 0.000 | 0.013 | 0.022 | 0.010 | 0.027 | 0.132 | 0.016 | 0.008 |
| Y | | | | | | | | | | | |
| Si | | | | | | | | | | | |
| F | 0.435 | 0.499 | 0.458 | 0.572 | 0.420 | 0.733 | 0.656 | 0.271 | 0.432 | 0.378 | 0.414 |
| OH* | 0.565 | 0.501 | 0.542 | 0.428 | 0.580 | 0.267 | 0.344 | 0.729 | 0.568 | 0.622 | 0.586 |
| Total | 4.643 | 4.618 | 4.469 | 4.598 | 4.459 | 4.857 | 4.610 | 4.556 | 4.911 | 4.691 | 4.559 |

Comments

| | Microlite<br>Marko's pegmatite<br>96-AT8 | | | | | | Antimonian<br>Microlite<br>Marko's peg.<br>96-AT8 | | Microlite<br>Marko's peg.<br>96-AT11A | | Microlite<br>Marko's peg.<br>96-AT12 | | Antimonian<br>Microlite<br>Marko's peg.<br>96-AT13 | | Microlite<br>Marko's peg.<br>96-AT15 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EH | EK | EL | EM | EN | EZ | EI | EJ | QC | QD | GG | GH | LH | LI | GA | GB | GC |
| Na2O | 3.41 | 3.62 | 4.07 | 3.81 | 4.08 | 4.27 | 2.60 | 2.95 | 0.94 | 1.24 | 4.79 | 4.65 | 2.91 | 3.49 | 2.93 | 2.45 | 2.80 |
| CaO | 13.06 | 12.79 | 13.29 | 12.99 | 12.89 | 12.73 | 12.95 | 12.78 | 6.40 | 5.87 | 12.24 | 12.37 | 10.58 | 11.83 | 10.46 | 10.59 | 9.69 |
| Al2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.00 | 6.89 | 5.41 | 0.00 | 0.00 | 0.72 | 0.01 | 1.38 | 0.07 | 1.61 |
| MnO | 0.03 | 0.02 | 0.02 | 0.06 | 0.07 | 0.15 | 0.10 | 0.06 | 0.03 | 0.03 | 0.09 | 0.01 | 0.87 | 0.17 | 0.15 | 0.00 | 0.12 |
| MgO | | | | | | | | | | | | | | | | | |
| TiO2 | 3.15 | 2.71 | 2.14 | 3.49 | 3.50 | 4.04 | 5.69 | 4.60 | 2.92 | 3.07 | 1.05 | 1.10 | 6.49 | 4.97 | 0.19 | 0.29 | 0.57 |
| Nb2O5 | 8.47 | 8.90 | 14.43 | 11.06 | 12.02 | 9.40 | 9.60 | 9.33 | 3.39 | 3.91 | 8.10 | 7.21 | 7.71 | 4.33 | 2.21 | 2.11 | 2.22 |
| Ta2O5 | 63.58 | 64.34 | 60.29 | 60.95 | 59.59 | 59.62 | 56.79 | 59.43 | 67.66 | 68.13 | 70.14 | 71.35 | 59.41 | 64.32 | 74.28 | 75.21 | 73.45 |
| SnO2 | 0.97 | 1.59 | 0.62 | 0.82 | 0.72 | 0.88 | 1.47 | 1.50 | 0.44 | 0.48 | 0.92 | 1.13 | 1.78 | 1.60 | 1.20 | 1.24 | 1.02 |
| WO3 | 0.36 | 0.38 | 0.37 | 0.44 | 0.37 | 0.77 | 0.43 | 0.42 | 0.36 | 0.28 | 0.40 | 0.53 | 0.23 | 0.13 | 0.27 | 0.04 | 0.37 |
| PbO | 0.01 | 0.06 | 0.04 | 0.09 | 0.05 | 0.23 | 0.00 | 0.03 | 0.29 | 0.15 | 0.00 | 0.00 | 0.10 | 0.00 | 0.11 | 0.23 | 0.11 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.08 | 0.03 | 0.00 | 0.23 | 0.00 | 0.02 | 0.20 | 0.00 | 0.38 |
| UO2 | 0.09 | 0.05 | 0.01 | 0.14 | 0.10 | 0.26 | 0.01 | 0.05 | 2.41 | 2.91 | 0.27 | 0.07 | 0.00 | 0.00 | 0.95 | 0.88 | 0.99 |
| Sb2O3 | 3.65 | 3.11 | 2.05 | 3.69 | 3.88 | 4.10 | 8.02 | 6.44 | 2.45 | 2.67 | 0.62 | 0.46 | 7.68 | 7.38 | 0.94 | 1.02 | 1.36 |
| Bi2O3 | 0.00 | 0.00 | 0.07 | 0.03 | 0.03 | 0.39 | 0.00 | 0.00 | 0.37 | 0.06 | 0.40 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 |
| Sc2O3 | 0.00 | 0.00 | 0.00 | 0.01 | 0.07 | 0.54 | 0.25 | 0.05 | 2.69 | 2.91 | 0.00 | 0.00 | 0.00 | 0.00 | 0.29 | 0.00 | 0.41 |
| Cs2O | 0.05 | 0.07 | 0.07 | 0.09 | 0.07 | 0.05 | 0.04 | 0.07 | 0.36 | 0.63 | 0.67 | 0.55 | 0.01 | 0.03 | 0.10 | 0.09 | 0.19 |
| BaO | | | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | | | | |
| F | 2.80 | 2.98 | 3.40 | 2.78 | 2.81 | 3.18 | 2.29 | 2.52 | 0.68 | 0.64 | 3.39 | 2.96 | 1.81 | 2.20 | 2.07 | 2.22 | 2.11 |
| H2O* | 1.02 | 0.88 | 0.55 | 1.15 | 1.12 | 0.65 | 1.69 | 1.40 | 3.02 | 3.08 | 0.42 | 0.87 | 2.21 | 1.63 | 1.43 | 1.28 | 1.39 |
| Subtotal | 100.65 | 101.52 | 101.41 | 101.60 | 101.39 | 101.28 | 101.99 | 101.64 | 101.36 | 101.51 | 103.50 | 103.47 | 102.50 | 102.14 | 99.16 | 97.73 | 99.05 |
| O=F | 1.18 | 1.26 | 1.43 | 1.17 | 1.18 | 1.34 | 0.96 | 1.06 | 0.29 | 0.27 | 1.43 | 1.25 | 0.76 | 0.93 | 0.87 | 0.93 | 0.89 |
| Total | 99.47 | 100.26 | 99.98 | 100.43 | 100.20 | 99.93 | 101.03 | 100.57 | 101.08 | 101.24 | 102.07 | 102.22 | 101.73 | 101.21 | 98.28 | 96.80 | 98.17 |
| **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | | |
| Ti | 0.198 | 0.168 | 0.130 | 0.213 | 0.214 | 0.253 | 0.345 | 0.282 | 0.196 | 0.202 | 0.066 | 0.069 | 0.386 | 0.313 | 0.013 | 0.020 | 0.039 |
| Nb | 0.320 | 0.331 | 0.525 | 0.406 | 0.441 | 0.353 | 0.351 | 0.344 | 0.137 | 0.155 | 0.305 | 0.271 | 0.276 | 0.164 | 0.091 | 0.086 | 0.092 |
| Ta | 1.443 | 1.441 | 1.318 | 1.345 | 1.315 | 1.348 | 1.248 | 1.317 | 1.643 | 1.621 | 1.590 | 1.612 | 1.277 | 1.466 | 1.846 | 1.848 | 1.823 |
| W | 0.008 | 0.008 | 0.008 | 0.009 | 0.008 | 0.017 | 0.009 | 0.009 | 0.008 | 0.006 | 0.009 | 0.011 | 0.005 | 0.003 | 0.006 | 0.001 | 0.009 |
| Sn | 0.032 | 0.052 | 0.020 | 0.026 | 0.023 | 0.029 | 0.047 | 0.049 | 0.016 | 0.017 | 0.030 | 0.037 | 0.056 | 0.054 | 0.044 | 0.045 | 0.037 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.515 | 0.396 | 0.000 | 0.000 | 0.048 | 0.000 | 0.105 | 0.006 | 0.123 |
| Mn | 0.002 | 0.001 | 0.001 | 0.004 | 0.005 | 0.011 | 0.007 | 0.004 | 0.002 | 0.003 | 0.006 | 0.001 | 0.058 | 0.012 | 0.011 | 0.000 | 0.009 |
| Mg | | | | | | | | | | | | | | | | | |
| Ca | 1.168 | 1.128 | 1.145 | 1.130 | 1.121 | 1.134 | 1.121 | 1.115 | 0.612 | 0.550 | 1.094 | 1.101 | 0.896 | 1.063 | 1.024 | 1.025 | 0.948 |
| Na | 0.552 | 0.579 | 0.635 | 0.600 | 0.642 | 0.689 | 0.408 | 0.466 | 0.163 | 0.211 | 0.774 | 0.750 | 0.446 | 0.567 | 0.519 | 0.430 | 0.495 |
| K | | | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | | | |
| Pb | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 | 0.005 | 0.000 | 0.001 | 0.007 | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.003 | 0.006 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.001 | 0.000 | 0.004 | 0.000 | 0.000 | 0.004 | 0.000 | 0.008 |
| U | 0.002 | 0.001 | 0.000 | 0.003 | 0.002 | 0.005 | 0.000 | 0.001 | 0.048 | 0.057 | 0.005 | 0.001 | 0.000 | 0.000 | 0.019 | 0.018 | 0.020 |
| Sb | 0.125 | 0.105 | 0.068 | 0.123 | 0.130 | 0.141 | 0.267 | 0.216 | 0.090 | 0.096 | 0.021 | 0.016 | 0.250 | 0.255 | 0.035 | 0.038 | 0.051 |
| Bi | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.008 | 0.000 | 0.000 | 0.008 | 0.001 | 0.009 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.006 |
| Cs | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 | 0.002 | 0.001 | 0.003 | 0.014 | 0.023 | 0.024 | 0.019 | 0.000 | 0.001 | 0.004 | 0.004 | 0.007 |
| Sc | 0.000 | 0.000 | 0.000 | 0.001 | 0.005 | 0.039 | 0.018 | 0.004 | 0.209 | 0.222 | 0.000 | 0.000 | 0.000 | 0.000 | 0.023 | 0.000 | 0.033 |
| Y | | | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | | | | |
| F | 0.739 | 0.776 | 0.863 | 0.714 | 0.722 | 0.837 | 0.585 | 0.650 | 0.191 | 0.178 | 0.893 | 0.777 | 0.453 | 0.583 | 0.598 | 0.633 | 0.608 |
| OH* | 0.261 | 0.224 | 0.137 | 0.286 | 0.278 | 0.163 | 0.415 | 0.350 | 0.809 | 0.822 | 0.107 | 0.223 | 0.547 | 0.417 | 0.402 | 0.367 | 0.392 |
| Total | 4.851 | 4.820 | 4.854 | 4.866 | 4.909 | 5.033 | 4.824 | 4.810 | 4.670 | 4.563 | 4.933 | 4.892 | 4.701 | 4.899 | 4.748 | 4.526 | 4.703 |

CommentsEH - EL traverse across inclEM & EN same grain

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Microlite**<br>**Marko's pegmatite**<br>96-AT17 | | | | | | | **Microlite**<br>**Marko's peg.**<br>96-AT19B | | | **Microlite**<br>**East Beryl peg.**<br>97-1A | **Microlite**<br>**School of Fish pegmatite**<br>97-71 | | | | |
| | RG | RI | RJ | RK | RL | RH | RY | DC | DV | DY | NA | FI | FJ | FK | FL | FM |
| Na2O | 3.94 | 4.15 | 4.12 | 3.95 | 3.92 | 4.51 | 4.57 | 4.36 | 4.32 | 4.06 | 3.23 | 1.20 | 1.18 | 2.43 | 2.86 | 1.22 |
| CaO | 11.94 | 11.94 | 12.02 | 11.91 | 12.30 | 12.49 | 11.76 | 12.18 | 12.15 | 12.38 | 12.82 | 15.48 | 15.50 | 8.06 | 10.48 | 16.28 |
| Al2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.01 | 0.01 | 0.02 | 0.06 | 0.02 | 0.01 | 0.01 | 0.00 | 0.01 | 0.17 | 0.80 | 0.14 | 0.14 | 0.24 | 0.36 | 0.10 |
| MnO | 0.06 | 0.05 | 0.03 | 0.07 | 0.06 | 0.02 | 0.02 | 0.06 | 0.05 | 0.26 | 0.05 | 0.18 | 0.18 | 0.18 | 0.15 | 0.14 |
| MgO | | | | | | | | | | | | | | | | |
| TiO2 | 3.71 | 3.19 | 3.08 | 3.89 | 3.49 | 1.56 | 2.02 | 0.93 | 0.80 | 0.76 | 0.02 | 1.96 | 2.02 | 2.03 | 1.96 | 1.70 |
| Nb2O5 | 5.84 | 6.53 | 6.66 | 6.77 | 6.12 | 6.12 | 5.45 | 3.34 | 3.44 | 4.19 | 4.86 | 4.46 | 4.42 | 4.83 | 4.43 | 5.88 |
| Ta2O5 | 65.38 | 66.19 | 66.34 | 65.10 | 65.94 | 70.87 | 69.31 | 73.60 | 72.64 | 71.65 | 68.50 | 68.94 | 68.57 | 72.53 | 69.85 | 70.79 |
| SnO2 | 1.40 | 1.28 | 1.30 | 1.33 | 1.20 | 0.90 | 2.82 | 1.58 | 2.27 | 2.64 | 5.03 | 2.75 | 2.85 | 2.59 | 2.69 | 1.80 |
| WO3 | 0.25 | 0.20 | 0.19 | 0.21 | 0.26 | 0.18 | 0.25 | 0.30 | 0.44 | 0.13 | 0.25 | 0.50 | 0.57 | 0.39 | 0.47 | 0.27 |
| PbO | 0.09 | 0.09 | 0.04 | 0.04 | 0.04 | 0.00 | 0.03 | 0.16 | 0.28 | 0.00 | 0.00 | 0.45 | 0.49 | 0.56 | 0.53 | 0.00 |
| ThO2 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.27 | 0.06 | 0.21 | 0.20 | 0.17 | 0.12 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.00 | 0.01 | 0.69 | 0.23 | 0.30 | 0.08 | 1.74 | 1.91 | 1.77 | 1.83 | 0.00 |
| Sb2O3 | 4.97 | 4.03 | 3.75 | 4.81 | 4.39 | 1.20 | 2.14 | 1.15 | 1.25 | 0.76 | 0.10 | 0.03 | 0.07 | 0.11 | 0.11 | 0.15 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.02 | 0.05 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.02 |
| Sc2O3 | 0.00 | 0.02 | 0.00 | 0.09 | 0.00 | 0.01 | 0.00 | 0.63 | 0.19 | 0.00 | 0.15 | 0.12 | 0.03 | 0.17 | 0.41 | 0.00 |
| Cs2O | 0.07 | 0.07 | 0.08 | 0.03 | 0.11 | 0.07 | 0.08 | 0.25 | 0.07 | 0.30 | 0.13 | 0.00 | 0.03 | 0.05 | 0.04 | 0.05 |
| BaO | | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | 1.83 | | | | | |
| F | 2.83 | 2.96 | 2.94 | 2.95 | 2.93 | 3.25 | 3.17 | 3.46 | 3.67 | 3.41 | 4.06 | 2.61 | 2.58 | 1.76 | 3.29 | 3.40 |
| H2O* | 0.97 | 0.84 | 0.87 | 0.91 | 0.88 | 0.50 | 0.64 | 0.17 | 0.00 | 0.24 | 0.00 | 2.22 | 2.18 | 1.06 | 1.01 | 1.21 |
| | | | | | | | | | | | | | | | | |
| Subtotal | 101.46 | 101.54 | 101.47 | 102.14 | 101.71 | 101.68 | 102.31 | 102.87 | 101.87 | 101.51 | 101.98 | 101.92 | 101.94 | 99.93 | 100.00 | 102.21 |
| O=F | 1.19 | 1.25 | 1.24 | 1.24 | 1.23 | 1.37 | 1.33 | 1.46 | 1.55 | 1.44 | 1.71 | 0.65 | 0.67 | 1.16 | 1.15 | 1.10 |
| Total | 100.27 | 100.29 | 100.23 | 100.90 | 100.48 | 100.31 | 100.97 | 101.41 | 100.32 | 100.08 | 100.27 | 101.26 | 101.26 | 98.77 | 98.86 | 101.11 |
| | | | | | | | | | | | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | |
| Ti | 0.234 | 0.201 | 0.194 | 0.241 | 0.220 | 0.099 | 0.127 | 0.061 | 0.052 | 0.050 | 0.002 | 0.125 | 0.129 | 0.124 | 0.125 | 0.106 |
| Nb | 0.221 | 0.247 | 0.252 | 0.252 | 0.232 | 0.234 | 0.205 | 0.132 | 0.135 | 0.164 | 0.192 | 0.172 | 0.170 | 0.178 | 0.169 | 0.222 |
| Ta | 1.492 | 1.506 | 1.507 | 1.459 | 1.502 | 1.632 | 1.569 | 1.745 | 1.717 | 1.692 | 1.626 | 1.598 | 1.591 | 1.605 | 1.605 | 1.606 |
| W | 0.006 | 0.004 | 0.004 | 0.004 | 0.006 | 0.004 | 0.005 | 0.007 | 0.010 | 0.003 | 0.006 | 0.011 | 0.013 | 0.008 | 0.010 | 0.006 |
| Sn | 0.047 | 0.043 | 0.043 | 0.044 | 0.040 | 0.030 | 0.094 | 0.055 | 0.079 | 0.091 | 0.175 | 0.093 | 0.097 | 0.084 | 0.090 | 0.060 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.001 | 0.001 | 0.002 | 0.004 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.012 | 0.058 | 0.010 | 0.010 | 0.016 | 0.026 | 0.007 |
| Mn | 0.004 | 0.003 | 0.002 | 0.005 | 0.004 | 0.001 | 0.001 | 0.005 | 0.004 | 0.019 | 0.004 | 0.013 | 0.013 | 0.013 | 0.010 | 0.010 |
| Mg | | | | | | | | | | | | | | | | |
| Ca | 1.073 | 1.070 | 1.076 | 1.051 | 1.104 | 1.133 | 1.049 | 1.138 | 1.131 | 1.151 | 1.199 | 1.414 | 1.416 | 0.703 | 0.949 | 1.456 |
| Na | 0.642 | 0.674 | 0.667 | 0.630 | 0.636 | 0.740 | 0.738 | 0.736 | 0.727 | 0.683 | 0.547 | 0.199 | 0.194 | 0.383 | 0.468 | 0.198 |
| K | | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | | |
| Pb | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.004 | 0.007 | 0.000 | 0.000 | 0.010 | 0.011 | 0.012 | 0.012 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.005 | 0.001 | 0.004 | 0.004 | 0.003 | 0.002 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.013 | 0.004 | 0.006 | 0.002 | 0.033 | 0.036 | 0.032 | 0.034 | 0.000 |
| Sb | 0.172 | 0.139 | 0.129 | 0.163 | 0.152 | 0.042 | 0.073 | 0.041 | 0.045 | 0.027 | 0.004 | 0.001 | 0.002 | 0.004 | 0.004 | 0.005 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Cs | 0.002 | 0.003 | 0.003 | 0.001 | 0.004 | 0.002 | 0.003 | 0.009 | 0.002 | 0.011 | 0.005 | 0.000 | 0.001 | 0.002 | 0.001 | 0.002 |
| Sc | 0.000 | 0.002 | 0.000 | 0.007 | 0.000 | 0.001 | 0.000 | 0.048 | 0.014 | 0.000 | 0.011 | 0.009 | 0.002 | 0.012 | 0.030 | 0.000 |
| Y | | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | 0.159 | | | | | |
| F | 0.751 | 0.783 | 0.776 | 0.768 | 0.775 | 0.870 | 0.[illegible]34 | 0.954 | 1.010 | 0.937 | 1.121 | 0.419 | 0.430 | 0.710 | 0.727 | 0.688 |
| OH* | 0.249 | 0.217 | 0.224 | 0.232 | 0.225 | 0.130 | 0.166 | 0.046 | 0.000 | 0.063 | 0.000 | 0.581 | 0.570 | 0.290 | 0.273 | 0.312 |
| Total | 4.897 | 4.893 | 4.881 | 4.863 | 4.904 | 4.920 | 4.867 | 4.995 | 4.945 | 4.915 | 5.111 | 4.692 | 4.691 | 4.180 | 4.537 | 4.677 |
| | | | | | | | | | | | | | | | | |
| CommentsAll from same inclusion in cassiterite | | | | | | RH & RY<br>rim | | replaces wodginite | | | incl. in<br>columbite | FI - FL<br>big fractured grain | | | | FM & FN<br>same gra |

### Microlite
### School of Fish pegmatite
97-71

| | FN | FO | FV | FW | FX | HA | HD | HG | HH | HI | HQ | HR | HS | HT | HU | HV | HZ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Na2O | 1.10 | 1.17 | 1.25 | 1.21 | 1.30 | 1.29 | 1.17 | 1.41 | 1.39 | 1.44 | 1.24 | 1.26 | 1.24 | 1.28 | 0.95 | 1.00 | 1.09 |
| CaO | 13.75 | 16.02 | 6.14 | 16.00 | 16.18 | 16.55 | 14.45 | 16.51 | 16.30 | 16.38 | 16.34 | 16.30 | 16.18 | 16.26 | 16.39 | 16.60 | 14.86 |
| Al2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.14 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 1.78 | 0.09 | 0.08 | 0.09 | 0.13 | 0.35 | 4.83 | 0.17 | 0.34 | 0.14 | 0.05 | 0.05 | 0.09 | 0.03 | 0.13 | 0.10 | 2.46 |
| MnO | 0.48 | 0.17 | 0.18 | 0.18 | 0.17 | 0.08 | 0.69 | 0.04 | 0.04 | 0.04 | 0.05 | 0.05 | 0.07 | 0.05 | 0.07 | 0.06 | 0.69 |
| MgO | | | | | | | | | | | | | | | | | |
| TiO2 | 2.47 | 1.37 | 1.75 | 1.65 | 2.05 | 2.31 | 8.44 | 2.20 | 2.27 | 2.21 | 1.71 | 1.66 | 1.57 | 1.61 | 1.45 | 1.56 | 5.55 |
| Nb2O5 | 9.26 | 5.58 | 6.20 | 5.73 | 6.68 | 5.82 | 4.83 | 6.22 | 6.30 | 5.90 | 6.41 | 6.25 | 6.30 | 6.16 | 5.97 | 5.84 | 6.59 |
| Ta2O5 | 65.92 | 70.49 | 70.11 | 70.68 | 68.33 | 68.06 | 59.97 | 69.33 | 68.77 | 69.84 | 70.03 | 70.43 | 70.02 | 70.09 | 70.44 | 70.71 | 64.68 |
| SnO2 | 2.89 | 2.43 | 1.94 | 1.88 | 2.03 | 2.83 | 2.49 | 2.03 | 2.03 | 1.82 | 1.93 | 2.00 | 2.19 | 2.18 | 2.37 | 2.19 | 1.98 |
| WO3 | 0.29 | 0.34 | 0.34 | 0.28 | 0.27 | 0.77 | 0.65 | 0.45 | 0.42 | 0.42 | 0.33 | 0.32 | 0.32 | 0.31 | 0.25 | 0.26 | 0.24 |
| PbO | 0.00 | 0.09 | 0.10 | 0.03 | 0.02 | 0.00 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.04 | 0.09 | 0.10 |
| ThO2 | 0.06 | 0.14 | 0.04 | 0.01 | 0.00 | 0.05 | 0.09 | 0.00 | 0.01 | 0.00 | 0.02 | 0.08 | 0.08 | 0.09 | 0.33 | 0.20 | 0.00 |
| UO2 | 0.00 | 0.37 | 0.02 | 0.04 | 0.01 | 0.07 | 0.00 | 0.00 | 0.05 | 0.00 | 0.09 | 0.01 | 0.09 | 0.03 | 0.28 | 0.23 | 0.00 |
| Sb2O3 | 0.09 | 0.02 | 0.21 | 0.20 | 0.34 | 0.00 | 0.00 | 0.20 | 0.21 | 0.22 | 0.18 | 0.21 | 0.14 | 0.17 | 0.00 | 0.00 | 0.10 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.37 | 0.00 | 0.06 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.00 |
| Sc2O3 | 0.23 | 0.01 | 0.00 | 0.09 | 0.13 | 0.01 | 0.16 | 0.00 | 0.11 | 0.02 | 0.00 | 0.11 | 0.04 | 0.08 | 0.04 | 0.00 | 0.10 |
| Cs2O | 0.04 | 0.05 | 0.08 | 0.05 | 0.03 | 0.07 | 0.05 | 0.06 | 0.03 | 0.09 | 0.02 | 0.04 | 0.00 | 0.06 | 0.09 | 0.06 | 0.03 |
| BaO | | | | | | | | | | | | | | | | | |
| K2O | | | | | | | | | | | | | | | | | |
| Y2O3 | | | | | | | | | | | | | | | | | |
| SiO2 | | | | | | | | | | | | | | | | | |
| F | 2.86 | 2.91 | 3.24 | 3.23 | 3.34 | 3.53 | 2.86 | 3.47 | 3.28 | 3.54 | 3.24 | 3.20 | 3.16 | 3.29 | 2.85 | 2.92 | 3.19 |
| H2O* | 1.40 | 2.05 | 0.52 | 0.39 | 0.96 | 0.31 | 1.28 | 0.37 | 0.56 | 0.28 | 0.58 | 0.63 | 0.66 | 0.52 | 0.96 | 0.90 | 0.86 |
| | | | | | | | | | | | | | | | | | |
| Subtotal | 102.33 | 102.15 | 102.25 | 101.89 | 101.85 | 102.10 | 102.25 | 102.47 | 102.10 | 102.33 | 102.20 | 102.60 | 102.13 | 102.22 | 102.60 | 102.74 | 102.51 |
| O=F | 1.09 | 0.74 | 1.39 | 1.43 | 1.21 | 1.49 | 1.21 | 1.46 | 1.38 | 1.49 | 1.36 | 1.35 | 1.33 | 1.38 | 1.20 | 1.23 | 1.34 |
| Total | 101.25 | 101.41 | 100.87 | 100.46 | 100.65 | 100.61 | 101.04 | 101.00 | 100.72 | 100.84 | 100.84 | 101.26 | 100.80 | 100.83 | 101.40 | 101.51 | 101.17 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | | | |
| Ti | 0.147 | 0.087 | 0.109 | 0.104 | 0.129 | 0.144 | 0.485 | 0.137 | 0.141 | 0.137 | 0.107 | 0.103 | 0.098 | 0.101 | 0.091 | 0.098 | 0.326 |
| Nb | 0.332 | 0.212 | 0.233 | 0.217 | 0.251 | 0.217 | 0.167 | 0.232 | 0.236 | 0.221 | 0.241 | 0.234 | 0.237 | 0.232 | 0.225 | 0.220 | 0.233 |
| Ta | 1.423 | 1.612 | 1.586 | 1.611 | 1.547 | 1.529 | 1.246 | 1.555 | 1.547 | 1.573 | 1.581 | 1.589 | 1.585 | 1.588 | 1.599 | 1.604 | 1.375 |
| W | 0.006 | 0.007 | 0.007 | 0.006 | 0.006 | 0.016 | 0.013 | 0.010 | 0.009 | 0.009 | 0.007 | 0.007 | 0.007 | 0.007 | 0.005 | 0.006 | 0.005 |
| Sn | 0.092 | 0.082 | 0.064 | 0.063 | 0.067 | 0.093 | 0.076 | 0.067 | 0.067 | 0.060 | 0.064 | 0.066 | 0.073 | 0.072 | 0.079 | 0.073 | 0.062 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.013 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.118 | 0.006 | 0.005 | 0.006 | 0.009 | 0.024 | 0.309 | 0.012 | 0.024 | 0.010 | 0.003 | 0.003 | 0.006 | 0.002 | 0.009 | 0.007 | 0.161 |
| Mn | 0.032 | 0.012 | 0.013 | 0.013 | 0.012 | 0.005 | 0.045 | 0.003 | 0.003 | 0.003 | 0.004 | 0.003 | 0.005 | 0.004 | 0.005 | 0.004 | 0.046 |
| Mg | | | | | | | | | | | | | | | | | |
| Ca | 1.169 | 1.443 | 1.438 | 1.437 | 1.443 | 1.465 | 1.183 | 1.459 | 1.445 | 1.453 | 1.453 | 1.449 | 1.444 | 1.451 | 1.466 | 1.483 | 1.244 |
| Na | 0.169 | 0.190 | 0.202 | 0.197 | 0.210 | 0.207 | 0.174 | 0.225 | 0.223 | 0.231 | 0.200 | 0.203 | 0.199 | 0.207 | 0.154 | 0.161 | 0.165 |
| K | | | | | | | | | | | | | | | | | |
| Ba | | | | | | | | | | | | | | | | | |
| Pb | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 |
| Th | 0.001 | 0.003 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.002 | 0.006 | 0.004 | 0.000 |
| U | 0.000 | 0.007 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.002 | 0.001 | 0.005 | 0.004 | 0.000 |
| Sb | 0.003 | 0.001 | 0.007 | 0.007 | 0.012 | 0.000 | 0.000 | 0.007 | 0.007 | 0.008 | 0.006 | 0.007 | 0.005 | 0.006 | 0.000 | 0.000 | 0.003 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.008 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Cs | 0.001 | 0.002 | 0.003 | 0.002 | 0.001 | 0.003 | 0.002 | 0.002 | 0.001 | 0.003 | 0.001 | 0.001 | 0.000 | 0.002 | 0.003 | 0.002 | 0.001 |
| Sc | 0.016 | 0.001 | 0.000 | 0.007 | 0.010 | 0.001 | 0.011 | 0.000 | 0.008 | 0.001 | 0.000 | 0.008 | 0.003 | 0.006 | 0.003 | 0.000 | 0.007 |
| Y | | | | | | | | | | | | | | | | | |
| Si | | | | | | | | | | | | | | | | | |
| F | 0.647 | 0.469 | 0.866 | 0.900 | 0.754 | 0.922 | 0.692 | 0.905 | 0.857 | 0.928 | 0.850 | 0.840 | 0.831 | 0.867 | 0.753 | 0.769 | 0.788 |
| OH* | 0.353 | 0.531 | 0.134 | 0.100 | 0.246 | 0.078 | 0.308 | 0.095 | 0.143 | 0.072 | 0.150 | 0.160 | 0.169 | 0.133 | 0.247 | 0.231 | 0.212 |
| Total | 4.509 | 4.667 | 4.672 | 4.670 | 4.705 | 4.707 | 4.727 | 4.708 | 4.712 | 4.709 | 4.668 | 4.677 | 4.665 | 4.680 | 4.652 | 4.669 | 4.629 |
| Comments in | | | FV - FX same grain | | | HA & HD same grian | | HG - HJ same grain | | | HQ - HT same grain | | | | HU & HP same grain | | |

| | Microlite<br>School of Fish pegmatite<br>97-264 | | | | | Microlite<br>Whopper<br>97-BW7A | Microlite<br>Big Whopper<br>97-BW7B | | Microlite<br>Whopper<br>98-SS27 | Microlite<br>Big Whopper pegmatite<br>98-SS29 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HC | HD | HE | HF | HG | GN | JA | JB | HG | DD | DF | DG | DH | DI | DK |
| $Na_2O$ | 0.48 | 0.47 | 0.46 | 0.64 | 0.62 | 0.42 | 2.55 | 3.49 | 3.20 | 2.61 | 2.84 | 2.94 | 2.76 | 2.70 | 2.88 |
| CaO | 16.02 | 16.15 | 16.05 | 17.81 | 17.70 | 11.32 | 10.48 | 9.73 | 6.08 | 12.62 | 13.86 | 13.90 | 13.20 | 13.44 | 13.91 |
| $Al_2O_3$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.34 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.09 | 0.10 | 0.11 | 0.11 | 0.13 | 2.66 | 1.02 | 0.49 | 2.10 | 0.22 | 0.08 | 0.09 | 0.18 | 0.15 | 0.09 |
| MnO | 0.08 | 0.08 | 0.07 | 0.07 | 0.07 | 1.17 | 0.46 | 0.21 | 0.09 | 0.11 | 0.10 | 0.09 | 0.11 | 0.10 | 0.11 |
| MgO | | | | | | | | | 0.26 | | | | | | |
| $TiO_2$ | 1.63 | 1.52 | 1.57 | 1.49 | 1.34 | 0.22 | 0.63 | 0.67 | 0.11 | 0.33 | 0.59 | 0.55 | 0.54 | 0.61 | 0.91 |
| $Nb_2O_5$ | 3.82 | 4.14 | 4.07 | 21.79 | 18.51 | 5.04 | 7.16 | 7.49 | 3.16 | 1.68 | 7.52 | 5.62 | 5.42 | 2.72 | 6.70 |
| $Ta_2O_5$ | 70.88 | 70.85 | 70.79 | 51.36 | 55.81 | 70.20 | 67.58 | 67.69 | 67.54 | 75.40 | 69.26 | 71.42 | 71.45 | 74.74 | 69.63 |
| $SnO_2$ | 1.84 | 1.72 | 1.75 | 2.22 | 2.19 | 5.36 | 2.61 | 2.83 | 0.63 | 2.32 | 2.48 | 2.60 | 2.69 | 1.86 | 2.10 |
| $WO_3$ | 0.30 | 0.30 | 0.34 | 0.49 | 0.40 | 0.23 | 0.53 | 0.32 | 0.20 | 0.20 | 0.22 | 0.20 | 0.23 | 0.48 | 0.35 |
| PbO | 0.31 | 0.27 | 0.24 | 0.09 | 0.09 | 0.21 | 0.43 | 0.33 | 0.42 | 0.07 | 0.09 | 0.04 | 0.04 | 0.05 | 0.23 |
| $ThO_2$ | 0.18 | 0.18 | 0.17 | 0.20 | 0.14 | 0.08 | 0.08 | 0.06 | 0.02 | 0.00 | 0.01 | 0.01 | 0.06 | 0.04 | 0.00 |
| $UO_2$ | 1.21 | 1.05 | 1.14 | 0.06 | 0.05 | 0.08 | 1.15 | 0.47 | 5.18 | 0.28 | 0.33 | 0.25 | 0.22 | 0.46 | 0.58 |
| $Sb_2O_3$ | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $Bi_2O_3$ | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.02 | 0.02 | 0.04 | 0.42 | 0.02 | 0.05 | 0.00 | 0.00 | 0.11 | 0.00 |
| $Sc_2O_3$ | 0.12 | 0.03 | 0.18 | 0.22 | 0.04 | 0.06 | 0.28 | 0.58 | 0.01 | | | | | | |
| $Cs_2O$ | 0.04 | 0.04 | 0.05 | 0.02 | 0.04 | 0.00 | 0.04 | 0.04 | | 0.06 | 0.06 | 0.03 | 0.05 | 0.08 | 0.00 |
| BaO | | | | | | | | | | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| $K_2O$ | | | | | | | | | 0.12 | 0.04 | 0.00 | 0.02 | 0.01 | 0.02 | 0.01 |
| $Y_2O_3$ | | | | | | | | | | | | | | | |
| $SiO_2$ | | | | | | 1.46 | 1.23 | 1.25 | 4.80 | | | | | | |
| F | 1.56 | 1.66 | 1.41 | 1.68 | 1.72 | 1.50 | 2.03 | 3.05 | 1.75 | 2.70 | 2.76 | 2.82 | 2.85 | 2.78 | 2.83 |
| $H_2O$* | 2.16 | 2.05 | 2.31 | 2.48 | 2.38 | 2.32 | 1.70 | 0.68 | 1.86 | 0.86 | 1.00 | 0.91 | 0.86 | 0.86 | 0.92 |
| Subtotal | 100.70 | 100.61 | 100.73 | 100.72 | 101.24 | 102.32 | 100.10 | 99.50 | 99.27 | 99.98 | 101.25 | 101.47 | 100.65 | 101.18 | 101.26 |
| O=F | 0.66 | 0.70 | 0.59 | 0.71 | 0.72 | 0.63 | 0.86 | 1.28 | 0.75 | 1.14 | 1.16 | 1.19 | 1.20 | 1.17 | 1.19 |
| Total | 100.05 | 99.91 | 100.14 | 100.01 | 100.52 | 101.69 | 99.24 | 98.21 | 98.52 | 98.84 | 100.09 | 100.29 | 99.45 | 100.01 | 100.07 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | | | |
| Ti | 0.106 | 0.099 | 0.103 | 0.086 | 0.079 | 0.014 | 0.041 | 0.043 | 0.008 | 0.022 | 0.038 | 0.035 | 0.035 | 0.040 | 0.058 |
| Nb | 0.150 | 0.162 | 0.160 | 0.759 | 0.656 | 0.192 | 0.278 | 0.288 | 0.131 | 0.068 | 0.287 | 0.217 | 0.209 | 0.107 | 0.257 |
| Ta | 1.674 | 1.672 | 1.669 | 1.077 | 1.189 | 1.609 | 1.580 | 1.566 | 1.688 | 1.824 | 1.588 | 1.655 | 1.660 | 1.777 | 1.606 |
| W | 0.007 | 0.007 | 0.008 | 0.010 | 0.008 | 0.005 | 0.012 | 0.007 | 0.005 | 0.004 | 0.005 | 0.005 | 0.005 | 0.011 | 0.008 |
| Sn | 0.064 | 0.059 | 0.061 | 0.068 | 0.068 | 0.180 | 0.090 | 0.096 | 0.023 | 0.082 | 0.083 | 0.088 | 0.092 | 0.065 | 0.071 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.145 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.007 | 0.007 | 0.008 | 0.007 | 0.008 | 0.188 | 0.073 | 0.035 | 0.161 | 0.016 | 0.005 | 0.006 | 0.013 | 0.011 | 0.007 |
| Mn | 0.006 | 0.006 | 0.005 | 0.005 | 0.005 | 0.083 | 0.033 | 0.015 | 0.007 | 0.008 | 0.007 | 0.006 | 0.008 | 0.007 | 0.008 |
| Mg | | | | | | | | | 0.035 | | | | | | |
| Ca | 1.491 | 1.502 | 1.491 | 1.471 | 1.486 | 1.022 | 0.965 | 0.887 | 0.599 | 1.202 | 1.252 | 1.270 | 1.208 | 1.259 | 1.264 |
| Na | 0.081 | 0.080 | 0.077 | 0.095 | 0.094 | 0.069 | 0.426 | 0.575 | 0.570 | 0.450 | 0.464 | 0.486 | 0.456 | 0.457 | 0.474 |
| K | | | | | | | | | 0.013 | 0.004 | 0.000 | 0.002 | 0.001 | 0.002 | 0.001 |
| Ba | | | | | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Pb | 0.007 | 0.006 | 0.006 | 0.002 | 0.002 | 0.005 | 0.010 | 0.007 | 0.010 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.005 |
| Th | 0.004 | 0.003 | 0.003 | 0.003 | 0.003 | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 |
| U | 0.023 | 0.020 | 0.022 | 0.001 | 0.001 | 0.001 | 0.022 | 0.009 | 0.106 | 0.006 | 0.006 | 0.005 | 0.004 | 0.009 | 0.011 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.003 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.010 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 |
| Cs | 0.002 | 0.001 | 0.002 | 0.001 | 0.001 | 0.000 | 0.001 | 0.002 | | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.000 |
| Sc | 0.009 | 0.002 | 0.013 | 0.015 | 0.003 | 0.004 | 0.021 | 0.043 | 0.001 | | | | | | |
| Y | | | | | | | | | | | | | | | |
| Si | | | | | | 0.123 | 0.105 | 0.106 | 0.441 | | | | | | |
| F | 0.427 | 0.456 | 0.388 | 0.410 | 0.425 | 0.398 | 0.553 | 0.821 | 0.510 | 0.760 | 0.737 | 0.759 | 0.769 | 0.768 | 0.759 |
| OH* | 0.573 | 0.544 | 0.612 | 0.590 | 0.575 | 0.602 | 0.447 | 0.179 | 0.490 | 0.240 | 0.263 | 0.241 | 0.231 | 0.232 | 0.241 |
| Total | 4.629 | 4.629 | 4.628 | 4.599 | 4.604 | 4.497 | 4.663 | 4.684 | 4.593 | 4.691 | 4.740 | 4.777 | 4.694 | 4.753 | 4.769 |
| Comments | HC - HE<br>same grain | | | HF & HG<br>same grain | | tiny<br>veinlet | | | lepidolite mass - borehole 98-38 | | | | | | |

| | Microlite Wolf peg. 99-WZ4 | | Uran-microlite Whopper DC97-7-55 | Microlite SW Beryl EFR-6056B | | Microlite Zone 11 99-ATZ11 |
|---|---|---|---|---|---|---|
| | DO | DP | AE | KI | KJ | ZA |
| Na2O | 1.49 | 2.63 | 1.24 | 3.74 | 2.54 | 0.18 |
| CaO | 9.31 | 6.89 | 8.21 | 9.04 | 8.86 | 16.40 |
| Al2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| FeO | 0.01 | 0.17 | 0.02 | 0.10 | 1.15 | 0.11 |
| MnO | 0.18 | 0.50 | 0.84 | 0.12 | 0.20 | 0.26 |
| MgO | | | | | | |
| TiO2 | 0.71 | 0.67 | 0.00 | 0.32 | 0.37 | 0.33 |
| Nb2O5 | 6.14 | 6.09 | 1.41 | 5.67 | 6.56 | 8.19 |
| Ta2O5 | 69.94 | 67.90 | 68.23 | 71.68 | 70.02 | 67.97 |
| SnO2 | 2.52 | 2.43 | 0.88 | 2.12 | 2.11 | 2.14 |
| WO3 | 0.61 | 2.05 | 0.18 | 0.12 | 0.09 | 0.24 |
| PbO | 0.67 | 0.61 | 5.34 | 0.82 | 0.67 | 0.04 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.11 |
| UO2 | 1.79 | 1.78 | 8.56 | 0.93 | 1.02 | 0.08 |
| Sb2O3 | 0.27 | 0.29 | 0.00 | 0.52 | 0.75 | 0.00 |
| Bi2O3 | 0.09 | 0.05 | 0.00 | 0.00 | 0.05 | 0.00 |
| Sc2O3 | 0.22 | 1.77 | 0.08 | 0.64 | 0.69 | 0.05 |
| Cs2O | | | 0.00 | 0.05 | 0.09 | 0.00 |
| BaO | 0.01 | 0.77 | | | | |
| K2O | 0.10 | 0.07 | | | | |
| Y2O3 | | | | | | |
| SiO2 | 1.42 | 1.58 | | 1.28 | 1.79 | 1.30 |
| F | 1.83 | 1.94 | 1.26 | 3.36 | 2.43 | 0.96 |
| H2O* | 1.87 | 1.76 | 1.93 | 0.32 | 1.27 | 2.91 |
| | | | | | | |
| Subtotal | 99.17 | 99.96 | 98.18 | 100.81 | 100.68 | 101.26 |
| O=F | 0.77 | 0.82 | 0.53 | 1.41 | 1.02 | 0.40 |
| Total | 98.40 | 99.14 | 97.65 | 99.40 | 99.65 | 100.85 |
| | | | | | | |
| | **Structural formulae based on 6 oxygens** | | | | | |
| Ti | 0.046 | 0.044 | 0.000 | 0.021 | 0.024 | 0.021 |
| Nb | 0.236 | 0.237 | 0.065 | 0.221 | 0.256 | 0.317 |
| Ta | 1.619 | 1.590 | 1.895 | 1.683 | 1.645 | 1.583 |
| W | 0.013 | 0.046 | 0.005 | 0.003 | 0.002 | 0.005 |
| Sn | 0.086 | 0.083 | 0.036 | 0.073 | 0.073 | 0.073 |
| Al | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Fe | 0.000 | 0.012 | 0.002 | 0.007 | 0.083 | 0.008 |
| Mn | 0.013 | 0.037 | 0.072 | 0.009 | 0.015 | 0.019 |
| Mg | | | | | | |
| Ca | 0.849 | 0.635 | 0.899 | 0.836 | 0.820 | 1.505 |
| Na | 0.246 | 0.438 | 0.244 | 0.625 | 0.425 | 0.031 |
| K | 0.011 | 0.008 | | | | |
| Ba | 0.000 | 0.026 | | | | |
| Pb | 0.015 | 0.014 | 0.147 | 0.019 | 0.016 | 0.001 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 |
| U | 0.034 | 0.034 | 0.194 | 0.018 | 0.020 | 0.002 |
| Sb | 0.009 | 0.010 | 0.000 | 0.019 | 0.027 | 0.000 |
| Bi | 0.002 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 |
| Cs | | | 0.000 | 0.002 | 0.003 | 0.000 |
| Sc | 0.016 | 0.133 | 0.007 | 0.048 | 0.052 | 0.004 |
| Y | | | | | | |
| Si | 0.121 | 0.136 | | 0.110 | 0.154 | 0.111 |
| F | 0.493 | 0.529 | 0.406 | 0.916 | 0.665 | 0.260 |
| OH* | 0.507 | 0.471 | 0.594 | 0.084 | 0.335 | 0.740 |
| Total | 4.316 | 4.485 | 4.566 | 4.693 | 4.616 | 4.682 |
| | | | | | | |
| Comments | DO & DP same grain | | rim around W-rich wodginite | inclusions in columbite Emerald Fields sample | | B23K1 |

# Ixiolite

| | Lou's pegmatite | | | | | Marko's pegmatite | | Pegmatite 9 | | | Peg. 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-272B | | | | | 94-44Y | | 94-318 | | | 95-117B |
| | RF | RN | RG | RO | RP | UA | UD | BC17 | BC18 | BC19 | RL |
| FeO | 4.27 | 4.16 | 4.69 | 4.80 | 3.94 | 9.23 | 8.53 | 15.57 | 15.23 | 14.15 | 12.42 |
| MnO | 11.81 | 11.62 | 12.63 | 12.17 | 11.93 | 9.09 | 8.98 | 1.85 | 1.74 | 1.49 | 5.13 |
| TiO2 | 4.91 | 5.17 | 4.83 | 4.31 | 4.83 | 4.10 | 3.89 | 2.14 | 2.58 | 3.18 | 3.03 |
| Nb2O5 | 37.06 | 35.73 | 34.38 | 34.46 | 35.74 | 37.68 | 39.47 | 31.51 | 25.69 | 19.39 | 46.33 |
| Ta2O5 | 37.76 | 39.77 | 40.44 | 40.45 | 40.23 | 36.87 | 36.31 | 39.77 | 40.51 | 41.26 | 27.09 |
| SnO2 | 1.07 | 1.02 | 1.22 | 1.15 | 1.07 | 1.84 | 1.38 | 2.17 | 4.81 | 8.48 | 0.63 |
| WO3 | 0.03 | 0.14 | 0.10 | 0.11 | 0.21 | 0.33 | 0.37 | 6.60 | 8.37 | 9.46 | 3.62 |
| PbO | 0.23 | 0.24 | 0.28 | 0.24 | 0.30 | 0.33 | 0.53 | 0.21 | 0.12 | 0.12 | 0.17 |
| ThO2 | 0.00 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.08 | 0.06 | 0.08 | 0.03 | 0.10 | 0.40 | 0.60 | 0.00 | 0.01 | 0.10 | 0.00 |
| Sb2O3 | 0.08 | 0.06 | 0.06 | 0.06 | 0.08 | 0.05 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | | | | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 1.35 | 1.28 | 1.16 | 1.57 | 1.30 | 0.03 | 0.07 | 0.03 | 0.20 | 0.29 | 0.28 |
| CaO | 0.07 | 0.07 | 0.05 | 0.07 | 0.05 | 0.06 | 0.04 | 0.02 | 0.11 | 0.15 | |
| Total | 98.72 | 99.33 | 99.92 | 99.43 | 99.78 | 100.01 | 100.26 | 99.86 | 99.37 | 98.07 | 98.68 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | |
| Fe | 0.234 | 0.229 | 0.259 | 0.266 | 0.216 | 0.507 | 0.466 | 0.894 | 0.894 | 0.860 | 0.665 |
| Mn | 0.657 | 0.647 | 0.705 | 0.683 | 0.664 | 0.506 | 0.497 | 0.107 | 0.103 | 0.092 | 0.278 |
| Ti | 0.242 | 0.255 | 0.239 | 0.215 | 0.239 | 0.202 | 0.191 | 0.111 | 0.136 | 0.174 | 0.146 |
| Nb | 1.100 | 1.061 | 1.025 | 1.033 | 1.061 | 1.119 | 1.165 | 0.978 | 0.816 | 0.637 | 1.340 |
| Ta | 0.674 | 0.711 | 0.725 | 0.729 | 0.719 | 0.658 | 0.645 | 0.742 | 0.774 | 0.815 | 0.471 |
| Sn | 0.028 | 0.027 | 0.032 | 0.030 | 0.028 | 0.048 | 0.036 | 0.059 | 0.135 | 0.246 | 0.016 |
| W | 0.001 | 0.002 | 0.002 | 0.002 | 0.004 | 0.006 | 0.006 | 0.117 | 0.152 | 0.178 | 0.060 |
| Pb | 0.004 | 0.004 | 0.005 | 0.004 | 0.005 | 0.006 | 0.009 | 0.004 | 0.002 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.006 | 0.009 | 0.000 | 0.000 | 0.002 | 0.000 |
| Sb | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | | | | | | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sc | 0.077 | 0.073 | 0.067 | 0.091 | 0.074 | 0.002 | 0.004 | 0.002 | 0.012 | 0.018 | 0.015 |
| Ca | 0.005 | 0.005 | 0.004 | 0.005 | 0.004 | 0.004 | 0.003 | 0.001 | 0.008 | 0.011 | |
| Total | 3.026 | 3.017 | 3.065 | 3.061 | 3.017 | 3.065 | 3.033 | 3.015 | 3.034 | 3.035 | 2.994 |
| Mn/(Mn+Fe) | 0.737 | 0.739 | 0.732 | 0.720 | 0.754 | 0.499 | 0.516 | 0.107 | 0.103 | 0.096 | 0.295 |
| Ta/(Ta+Nb) | 0.380 | 0.401 | 0.414 | 0.414 | 0.404 | 0.371 | 0.356 | 0.432 | 0.487 | 0.561 | 0.260 |
| Comments: | F & N same grain | | G, O & P same grain | | | isolated grains | | end of BC traverse | | | |
| | incl. in cass. | | incl. in cass. | | | close to selvedge | | Sn-W rich rim | | | |
| | high Sc & assoc. with stibiomicrolite | | | | | | | of normal ferrocolumbite | | | |

NOTE: All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

| | **Pegmatite 11** | | | **Treelined Lake** | | **Marko's peg.** | | **Big Whopper peg.** | | | **Pegmatite 7** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 95-117C | | | 96-2 | | 96-AT17 | | 97-BW4 | | | 97-P7-1 | | |
| | XC | XD | XJ | FG | FN | RM | RZ | RG | RH | RI | SM | SO | SP |
| FeO | 11.57 | 11.44 | 11.12 | 3.60 | 3.91 | 12.16 | 11.32 | 7.24 | 7.44 | 7.29 | 10.17 | 10.50 | 10.11 |
| MnO | 5.50 | 5.64 | 5.39 | 13.73 | 14.47 | 5.37 | 5.06 | 6.32 | 6.41 | 6.47 | 5.03 | 4.72 | 4.94 |
| TiO2 | 4.60 | 4.88 | 3.92 | 12.57 | 7.89 | 3.20 | 8.78 | 7.41 | 6.80 | 7.17 | 3.88 | 4.12 | 3.21 |
| Nb2O5 | 43.90 | 45.16 | 35.76 | 63.14 | 64.29 | 44.88 | 40.49 | 15.74 | 13.66 | 15.29 | 25.73 | 23.72 | 24.26 |
| Ta2O5 | 29.66 | 27.67 | 38.19 | 2.30 | 2.19 | 33.17 | 32.63 | 51.06 | 49.85 | 48.86 | 48.30 | 48.35 | 47.18 |
| SnO2 | 1.38 | 1.53 | 0.90 | 0.15 | 0.16 | 0.70 | 0.88 | 8.55 | 8.53 | 8.27 | 4.69 | 5.72 | 4.81 |
| WO3 | 2.32 | 2.26 | 3.13 | 3.14 | 4.35 | 0.31 | 0.22 | 2.71 | 6.07 | 5.13 | 1.73 | 2.25 | 3.51 |
| PbO | 0.27 | 0.23 | 0.16 | 0.28 | 0.32 | 0.22 | 0.19 | 0.02 | 0.00 | 0.16 | 0.07 | 0.12 | 0.14 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| UO2 | 0.07 | 0.08 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Sc2O3 | 0.27 | 0.54 | 0.37 | 1.54 | 1.33 | 0.27 | 0.30 | 0.26 | 0.32 | 0.07 | 0.29 | 0.23 | 0.32 |
| CaO | | | | 0.05 | 0.05 | 0.01 | 0.01 | 0.03 | 0.00 | 0.04 | 0.03 | 0.04 | 0.03 |
| Total | 99.53 | 99.43 | 98.94 | 100.45 | 98.91 | 100.28 | 99.91 | 99.34 | 99.07 | 98.76 | 99.91 | 99.75 | 98.50 |
| | **Structural formulae based on 6 oxygens** | | | | | | | | | | | | |
| Fe | 0.615 | 0.602 | 0.621 | 0.162 | 0.183 | 0.649 | 0.590 | 0.430 | 0.449 | 0.437 | 0.593 | 0.617 | 0.604 |
| Mn | 0.296 | 0.301 | 0.305 | 0.627 | 0.687 | 0.290 | 0.267 | 0.381 | 0.392 | 0.393 | 0.297 | 0.281 | 0.299 |
| Ti | 0.220 | 0.231 | 0.197 | 0.510 | 0.333 | 0.153 | 0.412 | 0.397 | 0.369 | 0.387 | 0.204 | 0.218 | 0.172 |
| Nb | 1.262 | 1.285 | 1.080 | 1.540 | 1.630 | 1.295 | 1.141 | 0.506 | 0.446 | 0.496 | 0.811 | 0.754 | 0.783 |
| Ta | 0.513 | 0.474 | 0.694 | 0.034 | 0.033 | 0.576 | 0.553 | 0.988 | 0.978 | 0.953 | 0.916 | 0.925 | 0.916 |
| Sn | 0.035 | 0.038 | 0.024 | 0.003 | 0.003 | 0.018 | 0.022 | 0.242 | 0.245 | 0.237 | 0.130 | 0.160 | 0.137 |
| W | 0.038 | 0.037 | 0.054 | 0.044 | 0.063 | 0.005 | 0.003 | 0.050 | 0.114 | 0.095 | 0.031 | 0.041 | 0.065 |
| Pb | 0.005 | 0.004 | 0.003 | 0.004 | 0.005 | 0.004 | 0.003 | 0.000 | 0.000 | 0.003 | 0.001 | 0.002 | 0.003 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | | | |
| Sc | 0.015 | 0.030 | 0.022 | 0.072 | 0.065 | 0.015 | 0.016 | 0.016 | 0.020 | 0.005 | 0.018 | 0.014 | 0.020 |
| Ca | | | | 0.003 | 0.003 | 0.001 | 0.000 | 0.003 | 0.000 | 0.003 | 0.002 | 0.003 | 0.002 |
| Total | 2.999 | 3.003 | 2.999 | 2.999 | 3.006 | 3.005 | 3.009 | 3.012 | 3.012 | 3.009 | 3.004 | 3.015 | 3.001 |
| Mn/(Mn+Fe) | 0.325 | 0.333 | 0.329 | 0.794 | 0.790 | 0.309 | 0.312 | 0.469 | 0.466 | 0.473 | 0.334 | 0.313 | 0.331 |
| Ta/(Ta+Nb) | 0.289 | 0.269 | 0.391 | 0.021 | 0.020 | 0.308 | 0.326 | 0.661 | 0.687 | 0.658 | 0.530 | 0.551 | 0.539 |
| Comments: | XC & XD<br>same grain | | attached to strüverite | small inclusions<br>in Nb rutile | | incl. in cass.<br>assoc. Sb microlite | | edge of col RA - RF<br>Ti, W wodginite<br>or ixiolite | | | occurs marginal to<br>wodginite | | |

|  | **Marko's** | **Marko's pegmatite** |  |  |  |  | **Peg. 11** | **Pegmatite 11** |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-44I | 94-44J |  |  |  |  | 95-117A | 95-117C |  |  |  |
|  | XB | ZU | ZV | KA | KB | KC | VC | XE | XF | XG | XI |
| FeO | 7.85 | 7.07 | 5.25 | 2.81 | 1.92 | 2.38 | 10.29 | 10.86 | 10.62 | 10.68 | 10.82 |
| MnO | 0.07 | 1.21 | 5.23 | 0.05 | 0.02 | 0.04 | 0.05 | 0.08 | 0.07 | 0.08 | 0.11 |
| TiO2 | 58.28 | 55.51 | 34.39 | 86.68 | 90.53 | 87.92 | 40.88 | 38.17 | 39.17 | 39.15 | 37.69 |
| Nb2O5 | 7.77 | 4.53 | 8.80 | 6.81 | 4.56 | 5.13 | 12.87 | 12.69 | 13.07 | 12.87 | 12.29 |
| Ta2O5 | 23.85 | 30.55 | 42.49 | 3.06 | 2.10 | 3.43 | 32.26 | 35.09 | 33.59 | 34.45 | 34.81 |
| SnO2 | 1.40 | 1.47 | 3.63 | 1.37 | 1.00 | 1.03 | 2.92 | 2.32 | 2.36 | 2.15 | 3.28 |
| WO3 | 0.02 | 0.01 | 0.00 | 0.11 | 0.00 | 0.04 | 0.55 | 0.82 | 0.84 | 0.84 | 0.95 |
| PbO | 0.03 | 0.02 | 0.02 | 0.01 | 0.04 | 0.03 | 0.03 | 0.05 | 0.00 | 0.07 | 0.03 |
| ThO2 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.01 | 0.00 | 0.00 |
| UO2 | 0.09 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 |
| Sb2O3 |  |  |  | 0.00 | 0.00 | 0.00 |  |  |  |  |  |
| Bi2O3 |  |  |  | 0.00 | 0.00 | 0.00 |  |  |  |  |  |
| Sc2O3 | 0.04 |  |  | 0.00 | 0.00 | 0.00 | 0.73 | 0.79 | 0.55 | 0.74 | 0.47 |
| CaO |  |  |  |  |  |  |  |  |  |  |  |
| Cr2O3 |  |  |  |  |  |  |  |  |  |  |  |
| Total | 99.42 | 100.40 | 99.81 | 100.88 | 100.16 | 100.00 | 100.59 | 100.88 | 100.27 | 101.03 | 100.46 |
|  | **Structural formulae based on 4 oxygens** |  |  |  |  |  |  |  |  |  |  |
| Fe | 0.218 | 0.201 | 0.172 | 0.065 | 0.044 | 0.055 | 0.312 | 0.335 | 0.327 | 0.327 | 0.337 |
| Mn | 0.002 | 0.035 | 0.173 | 0.001 | 0.000 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.003 |
| Ti | 1.455 | 1.421 | 1.011 | 1.814 | 1.876 | 1.846 | 1.114 | 1.060 | 1.084 | 1.078 | 1.056 |
| Nb | 0.117 | 0.070 | 0.156 | 0.086 | 0.057 | 0.065 | 0.211 | 0.212 | 0.217 | 0.213 | 0.207 |
| Ta | 0.215 | 0.283 | 0.452 | 0.023 | 0.016 | 0.026 | 0.318 | 0.352 | 0.336 | 0.343 | 0.353 |
| Sn | 0.019 | 0.020 | 0.057 | 0.015 | 0.011 | 0.011 | 0.042 | 0.034 | 0.035 | 0.031 | 0.049 |
| W | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.005 | 0.008 | 0.008 | 0.008 | 0.009 |
| Pb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb |  |  |  |  |  |  |  |  |  |  |  |
| Bi |  |  |  |  |  |  |  |  |  |  |  |
| Sc | 0.001 |  |  |  |  |  | 0.023 | 0.026 | 0.018 | 0.024 | 0.015 |
| Ca |  |  |  |  |  |  |  |  |  |  |  |
| Cr |  |  |  |  |  |  |  |  |  |  |  |
| Total | 2.027 | 2.030 | 2.021 | 2.006 | 2.004 | 2.006 | 2.028 | 2.031 | 2.027 | 2.028 | 2.030 |
| Comments: |  |  |  |  | KA - KC<br>same grain |  |  |  | XE - XG<br>same grain |  |  |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

## Strüverite

| | Treelined Lake Complex | | | | | | SW Beryl pegmatite | | | | Marko's |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-2 | | | | | | 96-9 | | | | 96-AT17 |
| | FB | FM | FC | FK | FE | FF | FM | FN | FO | FP | RN |
| FeO | 3.16 | 2.81 | 3.06 | 2.75 | 2.80 | 2.75 | 12.25 | 12.25 | 12.40 | 12.31 | 7.29 |
| MnO | 0.08 | 0.06 | 0.06 | 0.06 | 0.06 | 0.06 | 0.01 | 0.01 | 0.02 | 0.03 | 1.06 |
| TiO2 | 83.54 | 85.05 | 83.19 | 84.89 | 84.59 | 83.90 | 23.74 | 22.94 | 22.50 | 24.90 | 54.23 |
| Nb2O5 | 10.00 | 8.28 | 9.35 | 8.27 | 8.67 | 8.45 | 7.83 | 7.56 | 7.14 | 7.48 | 10.90 |
| Ta2O5 | 1.32 | 1.23 | 1.22 | 1.06 | 1.11 | 1.12 | 52.40 | 52.15 | 54.04 | 51.54 | 24.30 |
| SnO2 | 0.09 | 0.68 | 0.06 | 0.04 | 0.03 | 0.04 | 2.55 | 2.52 | 2.51 | 2.94 | 0.82 |
| WO3 | 0.42 | 0.06 | 0.41 | 0.26 | 0.24 | 0.26 | 0.39 | 0.36 | 0.40 | 0.44 | 0.17 |
| PbO | 0.01 | 0.01 | 0.00 | 0.02 | 0.04 | 0.03 | 0.03 | 0.03 | 0.00 | 0.00 | 0.00 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 |
| UO2 | 0.01 | 0.03 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.03 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 |
| Bi2O3 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.06 | 0.04 | 0.02 | 0.00 |
| Sc2O3 | 1.62 | 1.75 | 1.73 | 1.75 | 1.92 | 1.94 | 0.67 | 0.79 | 0.66 | 0.75 | 1.21 |
| CaO | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.01 | 0.01 |
| Cr2O3 | | | | | | | | | | | |
| Total | 100.26 | 99.94 | 99.08 | 99.11 | 99.48 | 98.54 | 99.92 | 98.72 | 99.71 | 100.42 | 100.01 |

**Structural formulae based on 4 oxygens**

| | FB | FM | FC | FK | FE | FF | FM | FN | FO | FP | RN |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Fe | 0.073 | 0.065 | 0.072 | 0.064 | 0.065 | 0.064 | 0.437 | 0.445 | 0.450 | 0.434 | 0.203 |
| Mn | 0.002 | 0.00[illegible] | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.030 |
| Ti | 1.744 | 1.775 | 1.752 | 1.778 | 1.767 | 1.770 | 0.762 | 0.749 | 0.734 | 0.789 | 1.362 |
| Nb | 0.126 | 0.104 | 0.118 | 0.104 | 0.109 | 0.107 | 0.151 | 0.148 | 0.140 | 0.142 | 0.165 |
| Ta | 0.010 | 0.009 | 0.009 | 0.008 | 0.008 | 0.009 | 0.608 | 0.616 | 0.637 | 0.591 | 0.221 |
| Sn | 0.001 | 0.007 | 0.001 | 0.000 | 0.000 | 0.000 | 0.043 | 0.044 | 0.043 | 0.049 | 0.011 |
| W | 0.003 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 | 0.004 | 0.004 | 0.004 | 0.005 | 0.001 |
| Pb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Sc | 0.039 | 0.042 | 0.042 | 0.042 | 0.046 | 0.047 | 0.025 | 0.030 | 0.025 | 0.028 | 0.035 |
| Ca | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Cr | | | | | | | | | | | |
| Total | 2.017 | 2.019 | 2.019 | 2.019 | 2.020 | 2.020 | 2.034 | 2.038 | 2.035 | 2.039 | 2.029 |

| Comments: | FB & FM<br>same grain | FC & FK<br>same grain |
|---|---|---|

| | Big Mack pegmatite | | | | | Big Mack pegmatite | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 98-83Ciii | | | | | 98-83Cii | | | | | | | | | |
| | FM | FO | FQ | FR | FS | UA | UC | UF | UP | UT | UW | VP | VT | VW | VX |
| FeO | 8.50 | 8.58 | 8.38 | 8.32 | 8.58 | 11.54 | 11.48 | 11.32 | 11.94 | 12.01 | 11.95 | 11.05 | 12.05 | 11.89 | 10.03 |
| MnO | 0.14 | 0.12 | 0.13 | 0.11 | 0.14 | 0.05 | 0.05 | 0.19 | 0.11 | 0.13 | 0.27 | 0.70 | 0.12 | 0.10 | 2.96 |
| TiO2 | 33.10 | 33.04 | 32.52 | 33.26 | 31.72 | 24.76 | 25.11 | 25.92 | 25.03 | 22.73 | 22.87 | 22.69 | 22.36 | 24.62 | 6.53 |
| Nb2O5 | 15.88 | 19.49 | 18.59 | 18.90 | 16.71 | 6.03 | 6.24 | 7.31 | 5.98 | 6.52 | 6.18 | 6.34 | 6.37 | 6.17 | 9.05 |
| Ta2O5 | 32.24 | 27.97 | 29.38 | 28.47 | 31.91 | 52.72 | 52.40 | 50.55 | 52.79 | 53.73 | 54.09 | 53.84 | 54.71 | 53.31 | 60.78 |
| SnO2 | 4.12 | 4.10 | 3.90 | 3.92 | 4.09 | 4.03 | 3.75 | 3.15 | 3.14 | 3.62 | 3.36 | 2.97 | 3.55 | 3.49 | 8.69 |
| WO3 | 0.28 | 0.27 | 0.39 | 0.37 | 0.39 | 0.50 | 0.60 | 0.54 | 0.97 | 0.67 | 0.59 | 0.94 | 0.65 | 0.61 | 1.35 |
| PbO | 0.00 | 0.13 | 0.01 | 0.07 | 0.00 | 0.07 | 0.02 | 0.00 | 0.07 | 0.00 | 0.08 | 0.32 | 0.00 | 0.00 | 0.06 |
| ThO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.00 | 0.06 | 0.00 | 0.04 | 0.00 |
| UO2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.03 | 0.01 | 0.03 | 0.01 | 0.00 | 0.00 | 0.00 |
| Sb2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Bi2O3 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.28 | 0.00 | 0.02 | 0.06 |
| Sc2O3 | 0.91 | 0.83 | 0.91 | 0.96 | 0.87 | 0.67 | 0.62 | 0.76 | 0.61 | 0.60 | 0.63 | 0.60 | 0.57 | 0.55 | 0.32 |
| CaO | 0.01 | 0.00 | 0.00 | 0.03 | 0.27 | 0.01 | 0.00 | 0.04 | 0.00 | 0.01 | 0.03 | 0.17 | 0.02 | 0.01 | 0.02 |
| Cr2O3 | 3.65 | 4.63 | 4.54 | 4.57 | 4.38 | | | | | | | | | | |
| Total | 98.83 | 99.17 | 98.74 | 98.99 | 99.07 | 100.37 | 100.27 | 99.78 | 100.67 | 100.03 | 100.09 | 99.80 | 100.39 | 100.82 | 99.83 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Fe | 0.275 | 0.273 | 0.270 | 0.266 | 0.279 | 0.410 | 0.407 | 0.398 | 0.423 | 0.422 | 0.435 | 0.420 | 0.402 | 0.437 | 0.422 |
| Mn | 0.005 | 0.004 | 0.004 | 0.004 | 0.005 | 0.002 | 0.002 | 0.007 | 0.004 | 0.004 | 0.005 | 0.004 | 0.026 | 0.004 | 0.004 |
| Ti | 0.963 | 0.947 | 0.942 | 0.955 | 0.928 | 0.792 | 0.801 | 0.819 | 0.797 | 0.763 | 0.739 | 0.778 | 0.742 | 0.729 | 0.785 |
| Nb | 0.278 | 0.336 | 0.324 | 0.326 | 0.294 | 0.116 | 0.120 | 0.139 | 0.115 | 0.113 | 0.127 | 0.126 | 0.125 | 0.125 | 0.118 |
| Ta | 0.339 | 0.290 | 0.308 | 0.296 | 0.338 | 0.609 | 0.604 | 0.578 | 0.608 | 0.631 | 0.632 | 0.612 | 0.636 | 0.645 | 0.615 |
| Sn | 0.064 | 0.062 | 0.060 | 0.060 | 0.064 | 0.068 | 0.063 | 0.053 | 0.053 | 0.068 | 0.063 | 0.064 | 0.052 | 0.061 | 0.059 |
| W | 0.003 | 0.003 | 0.004 | 0.004 | 0.004 | 0.006 | 0.007 | 0.006 | 0.011 | 0.007 | 0.007 | 0.007 | 0.011 | 0.007 | 0.007 |
| Pb | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.000 |
| Th | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| U | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Sb | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Bi | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.003 | 0.000 | 0.000 |
| Sc | 0.031 | 0.028 | 0.030 | 0.032 | 0.029 | 0.025 | 0.023 | 0.028 | 0.023 | 0.022 | 0.023 | 0.019 | 0.023 | 0.021 | 0.020 |
| Ca | 0.000 | 0.000 | 0.000 | 0.001 | 0.011 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.008 | 0.001 | 0.001 |
| Cr | 0.047 | 0.059 | 0.058 | 0.058 | 0.057 | | | | | | | | | | |
| Total | 2.004 | 2.003 | 2.000 | 2.001 | 2.009 | 2.029 | 2.026 | 2.028 | 2.034 | 2.029 | 2.032 | 2.029 | 2.030 | 2.030 | 2.031 |
| Comments: | FM - FS<br>all around<br>cordierite cluster | | FQ & FR<br>same grain | | | UA & UC<br>intergrown<br>grain | | | | | | | | | |

| | **Separation Rapids pluton** | | | | | **Separation Rapids pluton** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-260 | | | | | 93-260C | | | | | | | | |
| | NC | ND | NE | NF | NG | XA1 | XA2 | XA3 | XA4 | XA5 | XA6 | XA7 | XA8 | XA9 |
| SnO2 | 97.63 | 97.10 | 98.35 | 96.60 | 98.43 | 94.11 | 93.97 | 94.32 | 93.89 | 94.14 | 94.15 | 94.01 | 93.44 | 93.91 |
| FeO | 0.48 | 0.52 | 0.32 | 0.60 | 0.33 | 0.90 | 0.95 | 0.95 | 0.88 | 0.91 | 0.94 | 0.94 | 0.96 | 0.90 |
| MnO | 0.05 | 0.05 | 0.01 | 0.07 | 0.04 | 0.04 | 0.05 | 0.03 | 0.06 | 0.05 | 0.06 | 0.06 | 0.07 | 0.04 |
| Nb2O5 | 0.65 | 0.75 | 0.40 | 0.72 | 0.41 | 0.78 | 0.77 | 0.80 | 0.86 | 0.78 | 0.92 | 0.91 | 0.85 | 0.79 |
| Ta2O5 | 0.92 | 0.98 | 0.88 | 1.59 | 0.55 | 3.92 | 3.88 | 3.91 | 3.79 | 3.96 | 4.04 | 4.16 | 4.16 | 3.96 |
| Total | 99.73 | 99.40 | 99.96 | 99.58 | 99.76 | 99.75 | 99.62 | 100.00 | 99.47 | 99.85 | 100.11 | 100.07 | 99.47 | 99.61 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.955 | 1.950 | 1.967 | 1.938 | 1.971 | 1.891 | 1.890 | 1.890 | 1.891 | 1.890 | 1.884 | 1.882 | 1.883 | 1.890 |
| Fe | 0.020 | 0.022 | 0.013 | 0.025 | 0.014 | 0.038 | 0.040 | 0.040 | 0.037 | 0.038 | 0.039 | 0.039 | 0.040 | 0.038 |
| Mn | 0.002 | 0.002 | 0.000 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.002 | 0.003 | 0.002 | 0.003 | 0.002 |
| Nb | 0.015 | 0.017 | 0.009 | 0.016 | 0.009 | 0.018 | 0.018 | 0.018 | 0.020 | 0.018 | 0.021 | 0.021 | 0.019 | 0.018 |
| Ta | 0.013 | 0.013 | 0.012 | 0.022 | 0.008 | 0.054 | 0.053 | 0.053 | 0.052 | 0.054 | 0.055 | 0.057 | 0.057 | 0.054 |
| Total | 2.004 | 2.004 | 2.002 | 2.005 | 2.004 | 2.002 | 2.003 | 2.003 | 2.002 | 2.002 | 2.002 | 2.001 | 2.003 | 2.002 |
| Sn end | 97.525 | 97.279 | 98.256 | 96.689 | 98.384 | 94.448 | 94.363 | 94.383 | 94.444 | 94.388 | 94.103 | 94.049 | 94.008 | 94.398 |
| FeMn end | 1.112 | 1.199 | 0.692 | 1.408 | 0.777 | 1.980 | 2.103 | 2.041 | 1.981 | 2.014 | 2.098 | 2.083 | 2.165 | 1.981 |
| NbTa end | 1.363 | 1.522 | 1.053 | 1.902 | 0.840 | 3.573 | 3.534 | 3.576 | 3.575 | 3.598 | 3.799 | 3.868 | 3.828 | 3.622 |
| Nb+Ta | 0.027 | 0.030 | 0.021 | 0.038 | 0.017 | 0.072 | 0.071 | 0.072 | 0.072 | 0.072 | 0.076 | 0.077 | 0.077 | 0.072 |
| Fe+Mn | 0.022 | 0.024 | 0.014 | 0.028 | 0.016 | 0.040 | 0.042 | 0.041 | 0.040 | 0.040 | 0.042 | 0.042 | 0.043 | 0.040 |
| Comments: | | NC - NG | | | | | | traverse across anhedral crystal furthest away from inclusions | | | | | | |
| | | same grain | | | core | | | 1400 µm traverse - 100 µm intervals | | | | | | |

**NOTE:** All pertinent data are supplied in this table, however, additional information (calculations, ratios, etc.) is available on the Miscellaneous Release-Data (i.e., the electronic version).

| | Separation Rapids Pluton | | | | | E Beryl peg. | | East Beryl pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-260C | | | | | 93-265A | | 93-265F | | | | |
| | XA10 | XA11 | XA12 | XA13 | XA14 | LE | LF | UA | UC | UD | UE | UG |
| SnO2 | 94.35 | 94.36 | 94.34 | 95.46 | 94.89 | 98.23 | 97.54 | 94.71 | 95.17 | 96.47 | 95.32 | 95.71 |
| FeO | 0.83 | 0.88 | 0.89 | 0.74 | 0.81 | 0.11 | 0.18 | 0.73 | 0.62 | 0.58 | 0.64 | 0.66 |
| MnO | 0.04 | 0.04 | 0.03 | 0.04 | 0.04 | 0.10 | 0.20 | 0.09 | 0.05 | 0.08 | 0.04 | 0.09 |
| Nb2O5 | 0.79 | 0.85 | 0.82 | 0.70 | 0.76 | 0.06 | 0.07 | 0.73 | 0.59 | 0.52 | 0.61 | 0.64 |
| Ta2O5 | 3.53 | 3.79 | 3.70 | 3.13 | 3.34 | 1.18 | 1.90 | 2.90 | 2.41 | 2.60 | 2.79 | 2.57 |
| Total | 99.54 | 99.92 | 99.78 | 100.07 | 99.83 | 99.68 | 99.89 | 99.16 | 98.84 | 100.25 | 99.40 | 99.67 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.899 | 1.892 | 1.894 | 1.910 | 1.904 | 1.974 | 1.957 | 1.912 | 1.927 | 1.927 | 1.920 | 1.922 |
| Fe | 0.035 | 0.037 | 0.038 | 0.031 | 0.034 | 0.005 | 0.008 | 0.031 | 0.026 | 0.024 | 0.027 | 0.028 |
| Mn | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.004 | 0.009 | 0.004 | 0.002 | 0.003 | 0.002 | 0.004 |
| Nb | 0.018 | 0.019 | 0.019 | 0.016 | 0.017 | 0.001 | 0.002 | 0.017 | 0.014 | 0.012 | 0.014 | 0.015 |
| Ta | 0.048 | 0.052 | 0.051 | 0.043 | 0.046 | 0.016 | 0.026 | 0.040 | 0.033 | 0.035 | 0.038 | 0.035 |
| Total | 2.002 | 2.002 | 2.002 | 2.002 | 2.002 | 2.000 | 2.001 | 2.003 | 2.003 | 2.002 | 2.001 | 2.003 |
| Sn end | 94.846 | 94.502 | 94.599 | 95.437 | 95.085 | 98.678 | 97.816 | 95.438 | 96.239 | 96.259 | 95.952 | 95.937 |
| FeMn end | 1.833 | 1.946 | 1.940 | 1.632 | 1.768 | 0.445 | 0.805 | 1.735 | 1.422 | 1.383 | 1.437 | 1.579 |
| NbTa end | 3.321 | 3.552 | 3.461 | 2.930 | 3.147 | 0.877 | 1.379 | 2.827 | 2.339 | 2.358 | 2.612 | 2.484 |
| Nb+Ta | 0.066 | 0.071 | 0.069 | 0.059 | 0.063 | 0.018 | 0.028 | 0.057 | 0.047 | 0.047 | 0.052 | 0.050 |
| Fe+Mn | 0.037 | 0.039 | 0.039 | 0.033 | 0.035 | 0.009 | 0.016 | 0.035 | 0.028 | 0.028 | 0.029 | 0.032 |
| Comments: | | | | | | | | | UA - UE<br>same grain | | | core |

| | East Beryl pegmatite | | | | | E Beryl peg. | | East Beryl pegmatite | | | Audreys | Audreys |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-265K | | | | | 93-265N(ii) | | 93-265P | | | 93-271 | 93-271 |
| | YA | YB | YC | YD | YE | BG | BH | WH | WI | WJ | YA | YH |
| SnO2 | 97.77 | 96.20 | 95.64 | 95.87 | 95.08 | 96.60 | 97.94 | 98.55 | 98.16 | 99.10 | 97.97 | 97.89 |
| FeO | 0.32 | 0.60 | 0.77 | 0.53 | 0.71 | 0.52 | 0.34 | 0.13 | 0.20 | 0.21 | 0.57 | 0.46 |
| MnO | 0.03 | 0.04 | 0.05 | 0.11 | 0.04 | 0.07 | 0.05 | 0.05 | 0.04 | 0.03 | 0.07 | 0.10 |
| Nb2O5 | 0.41 | 0.62 | 1.20 | 0.50 | 0.96 | 0.50 | 0.35 | 0.18 | 0.04 | 0.09 | 0.21 | 0.18 |
| Ta2O5 | 1.07 | 2.39 | 2.20 | 2.11 | 2.85 | 1.98 | 1.16 | 0.42 | 0.94 | 0.76 | 1.48 | 1.14 |
| Total | 99.60 | 99.85 | 99.86 | 99.12 | 99.64 | 99.67 | 99.84 | 99.33 | 99.38 | 100.19 | 100.30 | 99.77 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.963 | 1.928 | 1.911 | 1.936 | 1.908 | 1.939 | 1.962 | 1.984 | 1.978 | 1.979 | 1.955 | 1.964 |
| Fe | 0.013 | 0.025 | 0.032 | 0.022 | 0.030 | 0.022 | 0.014 | 0.005 | 0.008 | 0.009 | 0.024 | 0.019 |
| Mn | 0.001 | 0.002 | 0.002 | 0.005 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.003 | 0.004 |
| Nb | 0.009 | 0.014 | 0.027 | 0.011 | 0.022 | 0.011 | 0.008 | 0.004 | 0.001 | 0.002 | 0.005 | 0.004 |
| Ta | 0.015 | 0.033 | 0.030 | 0.029 | 0.039 | 0.027 | 0.016 | 0.006 | 0.013 | 0.010 | 0.020 | 0.016 |
| Total | 2.001 | 2.002 | 2.003 | 2.003 | 2.001 | 2.003 | 2.002 | 2.001 | 2.002 | 2.002 | 2.007 | 2.007 |
| Sn end | 98.065 | 96.319 | 95.428 | 96.623 | 95.379 | 96.836 | 97.992 | 99.126 | 98.801 | 98.878 | 97.423 | 97.842 |
| FeMn end | 0.737 | 1.345 | 1.717 | 1.356 | 1.579 | 1.242 | 0.820 | 0.381 | 0.508 | 0.503 | 1.337 | 1.177 |
| NbTa end | 1.198 | 2.336 | 2.855 | 2.022 | 3.042 | 1.922 | 1.189 | 0.493 | 0.691 | 0.619 | 1.240 | 0.981 |
| Nb+Ta | 0.024 | 0.047 | 0.057 | 0.041 | 0.061 | 0.038 | 0.024 | 0.010 | 0.014 | 0.012 | 0.025 | 0.020 |
| Fe+Mn | 0.015 | 0.027 | 0.034 | 0.027 | 0.032 | 0.025 | 0.016 | 0.008 | 0.010 | 0.010 | 0.027 | 0.024 |
| Comments: | | YA - YE | | | | BG & BH | | WH - WJ same grain | | | YA & YH | |
| | | same grain | | | core | same grain | | pale | dark | dark | same grain | |
| | | | | | | | | contains many inclusions | | | | |

| | Lou's pegmatite | | | | | | Lou's pegmatite | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-272B | | | | | | 93-272E | | | | | | | |
| | XA | XE | XI | XK | XL | XP | WA | WB | WC | WD | WE | WF | JF | JG |
| SnO2 | 98.64 | 96.65 | 93.55 | 95.32 | 99.28 | 97.72 | 98.66 | 95.54 | 92.17 | 94.42 | 95.67 | 97.44 | 97.45 | 95.83 |
| FeO | 0.23 | 0.34 | 0.88 | 0.63 | 0.20 | 0.40 | 0.17 | 0.80 | 1.03 | 0.73 | 0.65 | 0.22 | 0.53 | 0.63 |
| MnO | 0.03 | 0.05 | 0.03 | 0.07 | 0.04 | 0.05 | 0.05 | 0.05 | 0.15 | 0.08 | 0.07 | 0.07 | 0.03 | 0.08 |
| Nb2O5 | 0.09 | 0.07 | 0.77 | 0.55 | 0.06 | 0.25 | 0.04 | 0.70 | 0.92 | 0.74 | 0.55 | 0.13 | 0.19 | 0.50 |
| Ta2O5 | 1.00 | 1.51 | 3.46 | 2.46 | 1.00 | 1.48 | 0.73 | 2.85 | 4.40 | 2.74 | 2.67 | 2.21 | 2.06 | 2.69 |
| Total | 99.99 | 98.62 | 98.69 | 99.03 | 100.58 | 99.90 | 99.65 | 99.94 | 98.67 | 98.71 | 99.61 | 100.07 | 100.26 | 99.73 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.975 | 1.964 | 1.899 | 1.927 | 1.976 | 1.958 | 1.982 | 1.914 | 1.872 | 1.914 | 1.923 | 1.952 | 1.948 | 1.925 |
| Fe | 0.009 | 0.014 | 0.037 | 0.027 | 0.008 | 0.017 | 0.007 | 0.034 | 0.044 | 0.031 | 0.027 | 0.009 | 0.022 | 0.027 |
| Mn | 0.001 | 0.002 | 0.001 | 0.003 | 0.002 | 0.002 | 0.002 | 0.002 | 0.006 | 0.003 | 0.003 | 0.003 | 0.001 | 0.003 |
| Nb | 0.002 | 0.002 | 0.018 | 0.013 | 0.001 | 0.006 | 0.001 | 0.016 | 0.021 | 0.017 | 0.013 | 0.003 | 0.004 | 0.011 |
| Ta | 0.014 | 0.021 | 0.048 | 0.034 | 0.014 | 0.020 | 0.010 | 0.039 | 0.061 | 0.038 | 0.037 | 0.030 | 0.028 | 0.037 |
| Total | 2.001 | 2.003 | 2.003 | 2.003 | 2.001 | 2.003 | 2.002 | 2.004 | 2.005 | 2.004 | 2.003 | 1.998 | 2.004 | 2.003 |
| Sn end | 98.680 | 98.044 | 94.790 | 96.194 | 98.752 | 97.761 | 98.991 | 95.481 | 93.391 | 95.539 | 96.029 | 97.729 | 97.211 | 96.096 |
| FeMn end | 0.536 | 0.831 | 1.935 | 1.483 | 0.502 | 0.946 | 0.464 | 1.783 | 2.512 | 1.721 | 1.518 | 0.612 | 1.172 | 1.495 |
| NbTa end | 0.784 | 1.125 | 3.276 | 2.322 | 0.746 | 1.293 | 0.545 | 2.736 | 4.097 | 2.740 | 2.454 | 1.660 | 1.616 | 2.408 |
| Nb+Ta | 0.016 | 0.023 | 0.066 | 0.047 | 0.015 | 0.026 | 0.011 | 0.055 | 0.082 | 0.055 | 0.049 | 0.033 | 0.032 | 0.048 |
| Fe+Mn | 0.011 | 0.017 | 0.039 | 0.030 | 0.010 | 0.019 | 0.009 | 0.036 | 0.050 | 0.034 | 0.030 | 0.012 | 0.023 | 0.030 |
| Comments: | | XE & XI<br>same grain | | XK & XL<br>same grain | | | | | WA - WD & WF same grain<br>contains microlite and ferrowodginite inclusions | | | | | |
| | | large euhedral crystals in cluster | | | | | | | core | | | | | |

| | **Lou's pegmatite** | | | | **Marko's pegmatite** | | | **Marko's** | **James' peg.** | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 93-272E | | | | 93-275C | | | 93-275D | 93-276A | |
| | JH | JI | JL | JM | BC | BD | BF | CC | CK | CP |
| SnO2 | 97.29 | 96.31 | 96.41 | 98.19 | 97.28 | 98.87 | 97.55 | 97.06 | 97.38 | 96.52 |
| FeO | 0.63 | 0.64 | 0.64 | 0.45 | 0.14 | 0.12 | 0.14 | 0.16 | 0.31 | 0.51 |
| MnO | 0.03 | 0.04 | 0.01 | 0.05 | 0.33 | 0.14 | 0.22 | 0.28 | 0.07 | 0.08 |
| Nb2O5 | 0.57 | 0.56 | 0.52 | 0.35 | 0.15 | 0.01 | 0.09 | 0.13 | 0.10 | 0.16 |
| Ta2O5 | 2.35 | 2.67 | 2.45 | 1.58 | 2.02 | 0.55 | 1.27 | 1.74 | 1.80 | 2.33 |
| Total | 100.87 | 100.22 | 100.03 | 100.62 | 99.92 | 99.69 | 99.27 | 99.37 | 99.66 | 99.60 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.930 | 1.924 | 1.930 | 1.953 | 1.951 | 1.985 | 1.968 | 1.957 | 1.958 | 1.943 |
| Fe | 0.026 | 0.027 | 0.027 | 0.019 | 0.006 | 0.005 | 0.006 | 0.007 | 0.013 | 0.022 |
| Mn | 0.001 | 0.002 | 0.000 | 0.002 | 0.014 | 0.006 | 0.009 | 0.012 | 0.003 | 0.003 |
| Nb | 0.013 | 0.013 | 0.012 | 0.008 | 0.003 | 0.000 | 0.002 | 0.003 | 0.002 | 0.004 |
| Ta | 0.032 | 0.036 | 0.033 | 0.021 | 0.028 | 0.008 | 0.017 | 0.024 | 0.025 | 0.032 |
| Total | 2.003 | 2.002 | 2.002 | 2.003 | 2.002 | 2.004 | 2.003 | 2.003 | 2.001 | 2.004 |
| Sn end | 96.399 | 96.124 | 96.377 | 97.494 | 97.453 | 99.063 | 98.258 | 97.720 | 97.850 | 96.976 |
| FeMn end | 1.372 | 1.424 | 1.363 | 1.043 | 0.996 | 0.550 | 0.766 | 0.937 | 0.803 | 1.245 |
| NbTa end | 2.228 | 2.451 | 2.260 | 1.464 | 1.550 | 0.387 | 0.975 | 1.343 | 1.347 | 1.779 |
| Nb+Ta | 0.045 | 0.049 | 0.045 | 0.029 | 0.031 | 0.008 | 0.020 | 0.027 | 0.027 | 0.036 |
| Fe+Mn | 0.027 | 0.029 | 0.027 | 0.021 | 0.020 | 0.011 | 0.015 | 0.019 | 0.016 | 0.025 |
| Comments: | | | | | BC & BD same grain | | perfectly euhedral basal section | rim | CK & CP same grain | |

**James' pegmatite**

93-276B

| | PF | PG | PH | PI | PL | PN | PY | SD | SG | SH |
|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 96.52 | 97.79 | 97.72 | 96.21 | 97.67 | 96.83 | 92.14 | 96.95 | 96.88 | 94.06 |
| FeO | 0.37 | 0.31 | 0.24 | 0.57 | 0.27 | 0.40 | 1.02 | 0.27 | 0.36 | 0.72 |
| MnO | 0.05 | 0.03 | 0.05 | 0.07 | 0.04 | 0.10 | 0.07 | 0.04 | 0.04 | 0.09 |
| Nb2O5 | 0.12 | 0.13 | 0.07 | 0.13 | 0.10 | 0.24 | 0.70 | 0.13 | 0.15 | 0.66 |
| Ta2O5 | 1.97 | 1.57 | 1.23 | 2.43 | 1.42 | 1.98 | 5.22 | 1.44 | 1.67 | 3.28 |
| Total | 99.03 | 99.83 | 99.31 | 99.41 | 99.50 | 99.55 | 99.15 | 98.83 | 99.10 | 98.81 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.954 | 1.962 | 1.971 | 1.941 | 1.966 | 1.949 | 1.867 | 1.965 | 1.958 | 1.907 |
| Fe | 0.016 | 0.013 | 0.010 | 0.024 | 0.011 | 0.017 | 0.043 | 0.011 | 0.015 | 0.031 |
| Mn | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.004 | 0.003 | 0.002 | 0.002 | 0.004 |
| Nb | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | 0.005 | 0.016 | 0.003 | 0.003 | 0.015 |
| Ta | 0.027 | 0.021 | 0.017 | 0.033 | 0.019 | 0.027 | 0.072 | 0.020 | 0.023 | 0.045 |
| Total | 2.001 | 2.001 | 2.002 | 2.004 | 2.001 | 2.002 | 2.001 | 2.001 | 2.002 | 2.002 |
| Sn end | 97.611 | 98.073 | 98.461 | 96.831 | 98.257 | 97.313 | 93.276 | 98.196 | 97.830 | 95.254 |
| FeMn end | 0.892 | 0.705 | 0.614 | 1.353 | 0.655 | 1.057 | 2.316 | 0.660 | 0.848 | 1.723 |
| NbTa end | 1.496 | 1.222 | 0.925 | 1.816 | 1.088 | 1.631 | 4.407 | 1.144 | 1.322 | 3.023 |
| Nb+Ta | 0.030 | 0.024 | 0.019 | 0.036 | 0.022 | 0.033 | 0.088 | 0.023 | 0.026 | 0.061 |
| Fe+Mn | 0.018 | 0.014 | 0.012 | 0.027 | 0.013 | 0.021 | 0.046 | 0.013 | 0.017 | 0.034 |

Comments: contains columbite and many ferrowodginite inclusions

| | **James' pegmatite** | | | **James' peg.** | | **James' pegmatite** | | | | **James' pegmatite** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 93-276C | | | 93-276C | | 93-276D | | | | 93-276E | | | | |
| | KA | KB | KC | KD | KE | QA | QB | QC | QD | HA | HB | HC | HD | HE |
| SnO2 | 96.05 | 95.90 | 96.80 | 96.81 | 98.27 | 96.51 | 96.38 | 97.46 | 97.61 | 98.30 | 99.11 | 99.45 | 98.50 | 98.85 |
| FeO | 0.84 | 0.76 | 0.58 | 0.90 | 0.35 | 0.39 | 0.34 | 0.33 | 0.26 | 0.33 | 0.25 | 0.18 | 0.32 | 0.18 |
| MnO | 0.04 | 0.09 | 0.08 | 0.04 | 0.12 | 0.05 | 0.04 | 0.04 | 0.04 | 0.07 | 0.03 | 0.01 | 0.04 | 0.04 |
| Nb2O5 | 0.52 | 0.64 | 0.52 | 0.25 | 0.32 | 0.30 | 0.32 | 0.32 | 0.22 | 0.07 | 0.10 | 0.09 | 0.18 | 0.13 |
| Ta2O5 | 2.32 | 2.52 | 2.35 | 2.47 | 1.46 | 1.39 | 1.34 | 1.09 | 0.96 | 1.55 | 1.18 | 0.98 | 1.31 | 0.61 |
| Total | 99.77 | 99.91 | 100.33 | 100.47 | 100.52 | 98.64 | 98.42 | 99.24 | 99.09 | 100.32 | 100.67 | 100.71 | 100.35 | 99.81 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.927 | 1.921 | 1.931 | 1.931 | 1.956 | 1.958 | 1.959 | 1.964 | 1.971 | 1.963 | 1.971 | 1.977 | 1.965 | 1.981 |
| Fe | 0.035 | 0.032 | 0.024 | 0.038 | 0.015 | 0.017 | 0.014 | 0.014 | 0.011 | 0.014 | 0.010 | 0.008 | 0.013 | 0.008 |
| Mn | 0.002 | 0.004 | 0.003 | 0.002 | 0.005 | 0.002 | 0.002 | 0.002 | 0.002 | 0.003 | 0.001 | 0.000 | 0.002 | 0.002 |
| Nb | 0.012 | 0.015 | 0.012 | 0.006 | 0.007 | 0.007 | 0.007 | 0.007 | 0.005 | 0.002 | 0.002 | 0.002 | 0.004 | 0.003 |
| Ta | 0.032 | 0.034 | 0.032 | 0.034 | 0.020 | 0.019 | 0.019 | 0.015 | 0.013 | 0.021 | 0.016 | 0.013 | 0.018 | 0.008 |
| Total | 2.008 | 2.006 | 2.003 | 2.010 | 2.003 | 2.003 | 2.002 | 2.002 | 2.002 | 2.003 | 2.001 | 2.000 | 2.002 | 2.002 |
| Sn end | 95.984 | 95.776 | 96.435 | 96.089 | 97.667 | 97.759 | 97.893 | 98.104 | 98.452 | 98.028 | 98.503 | 98.838 | 98.153 | 98.973 |
| FeMn end | 1.845 | 1.783 | 1.381 | 1.958 | 0.983 | 0.936 | 0.811 | 0.782 | 0.636 | 0.838 | 0.584 | 0.396 | 0.753 | 0.463 |
| NbTa end | 2.170 | 2.441 | 2.184 | 1.953 | 1.350 | 1.305 | 1.297 | 1.114 | 0.912 | 1.133 | 0.913 | 0.766 | 1.094 | 0.564 |
| Nb+Ta | 0.044 | 0.049 | 0.044 | 0.039 | 0.027 | 0.026 | 0.026 | 0.022 | 0.018 | 0.023 | 0.018 | 0.015 | 0.022 | 0.011 |
| Fe+Mn | 0.037 | 0.036 | 0.028 | 0.039 | 0.020 | 0.019 | 0.016 | 0.016 | 0.013 | 0.017 | 0.012 | 0.008 | 0.015 | 0.009 |
| Comments: | KA - KE<br>same grain | | | | | QA - QD same grain<br>core | | | | HA - HE same grain<br>core | | | | |

| | James' pegmatite<br>93-276F | | | | | SW Beryl pegmatite<br>94-15A | | | SW Beryl pegmatite<br>94-15A | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DA | DB | DC | DD | DE | FA | FB | FF | FH | FI | FJ | CF |
| SnO2 | 97.69 | 99.05 | 99.28 | 97.92 | 99.42 | 99.20 | 99.51 | 98.61 | 99.16 | 99.80 | 100.01 | 94.26 |
| FeO | 0.50 | 0.25 | 0.17 | 0.25 | 0.18 | 0.19 | 0.19 | 0.28 | 0.16 | 0.13 | 0.14 | 1.09 |
| MnO | 0.05 | 0.05 | 0.01 | 0.03 | 0.03 | 0.04 | 0.04 | 0.03 | 0.03 | 0.03 | 0.01 | 0.18 |
| Nb2O5 | 0.32 | 0.25 | 0.15 | 0.21 | 0.03 | 0.03 | 0.10 | 0.10 | 0.09 | 0.09 | 0.09 | 2.28 |
| Ta2O5 | 1.99 | 0.84 | 0.72 | 1.13 | 0.88 | 0.57 | 0.76 | 1.56 | 0.60 | 0.70 | 0.52 | 2.71 |
| | | | | | | | | | | | | |
| Total | 100.55 | 100.44 | 100.33 | 99.54 | 100.54 | 100.03 | 100.60 | 100.58 | 100.04 | 100.75 | 100.77 | 100.52 |
| | | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.946 | 1.972 | 1.980 | 1.969 | 1.980 | 1.985 | 1.979 | 1.964 | 1.983 | 1.982 | 1.986 | 1.864 |
| Fe | 0.021 | 0.010 | 0.007 | 0.011 | 0.008 | 0.008 | 0.008 | 0.012 | 0.007 | 0.005 | 0.006 | 0.045 |
| Mn | 0.002 | 0.002 | 0.000 | 0.001 | 0.001 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 | 0.000 | 0.008 |
| Nb | 0.007 | 0.006 | 0.003 | 0.005 | 0.001 | 0.001 | 0.002 | 0.002 | 0.002 | 0.002 | 0.002 | 0.051 |
| Ta | 0.027 | 0.011 | 0.010 | 0.015 | 0.012 | 0.008 | 0.010 | 0.021 | 0.008 | 0.009 | 0.007 | 0.037 |
| | | | | | | | | | | | | |
| Total | 2.003 | 2.002 | 2.000 | 2.001 | 2.001 | 2.003 | 2.002 | 2.001 | 2.001 | 2.000 | 2.001 | 2.004 |
| | | | | | | | | | | | | |
| Sn end | 97.141 | 98.521 | 98.964 | 98.395 | 98.930 | 99.095 | 98.892 | 98.180 | 99.090 | 99.091 | 99.234 | 92.994 |
| FeMn end | 1.148 | 0.627 | 0.377 | 0.591 | 0.439 | 0.483 | 0.480 | 0.648 | 0.399 | 0.334 | 0.312 | 2.633 |
| NbTa end | 1.710 | 0.852 | 0.659 | 1.014 | 0.631 | 0.422 | 0.628 | 1.172 | 0.511 | 0.575 | 0.453 | 4.374 |
| | | | | | | | | | | | | |
| Nb+Ta | 0.034 | 0.017 | 0.013 | 0.020 | 0.013 | 0.008 | 0.013 | 0.023 | 0.010 | 0.012 | 0.009 | 0.088 |
| Fe+Mn | 0.023 | 0.013 | 0.008 | 0.012 | 0.009 | 0.010 | 0.010 | 0.013 | 0.008 | 0.007 | 0.006 | 0.053 |
| | | | | | | | | | | | | |
| Comments: | DA - DE same grain | | | | | FA & FB same grain<br>contains inclusions<br>of wodginite | | | FH - FJ<br>from mineral separate | | | from<br>polished<br>section |
| | | | | | | | | | separate & section cassiterites | | | |

have different compositions

## Cassiterite

| | **SW Beryl pegmatite** | | | | **SW Beryl pegmatite** | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-15B | | | | 94-15B | | | | | | | | |
| | AB | AC | AD | AE | AJ | AK | AL | AM | CC | CD | CK | CI | CJ |
| SnO2 | 91.29 | 99.02 | 95.47 | 98.11 | 95.93 | 98.97 | 94.91 | 97.27 | 95.17 | 98.29 | 99.18 | 95.92 | 95.93 |
| FeO | 1.23 | 0.16 | 0.74 | 0.35 | 0.70 | 0.21 | 0.84 | 0.43 | 0.75 | 0.27 | 0.20 | 0.59 | 0.58 |
| MnO | 0.35 | 0.01 | 0.10 | 0.02 | 0.05 | 0.00 | 0.02 | 0.04 | 0.03 | 0.00 | 0.02 | 0.05 | 0.04 |
| Nb2O5 | 2.29 | 0.14 | 1.92 | 1.12 | 1.28 | 0.10 | 0.72 | 1.05 | 0.98 | 0.13 | 0.18 | 1.00 | 0.99 |
| Ta2O5 | 5.22 | 0.63 | 1.65 | 0.45 | 1.69 | 0.80 | 3.53 | 0.60 | 2.66 | 1.18 | 0.66 | 2.08 | 1.84 |
| Total | 100.38 | 99.96 | 99.88 | 100.06 | 99.64 | 100.08 | 100.02 | 99.39 | 99.59 | 99.88 | 100.24 | 99.64 | 99.39 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.814 | 1.982 | 1.900 | 1.953 | 1.919 | 1.979 | 1.901 | 1.950 | 1.910 | 1.970 | 1.979 | 1.923 | 1.927 |
| Fe | 0.051 | 0.007 | 0.031 | 0.015 | 0.029 | 0.009 | 0.035 | 0.018 | 0.032 | 0.011 | 0.009 | 0.025 | 0.024 |
| Mn | 0.015 | 0.000 | 0.004 | 0.001 | 0.002 | 0.000 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.002 | 0.002 |
| Nb | 0.052 | 0.003 | 0.043 | 0.025 | 0.029 | 0.002 | 0.016 | 0.024 | 0.022 | 0.003 | 0.004 | 0.023 | 0.023 |
| Ta | 0.071 | 0.009 | 0.022 | 0.006 | 0.023 | 0.011 | 0.048 | 0.008 | 0.036 | 0.016 | 0.009 | 0.028 | 0.025 |
| Total | 2.002 | 2.000 | 2.001 | 2.000 | 2.003 | 2.001 | 2.002 | 2.002 | 2.002 | 2.001 | 2.001 | 2.001 | 2.001 |
| Sn end | 90.596 | 99.067 | 94.965 | 97.658 | 95.836 | 98.905 | 94.972 | 97.413 | 95.424 | 98.468 | 98.884 | 96.091 | 96.301 |
| FeMn end | 3.290 | 0.338 | 1.753 | 0.767 | 1.571 | 0.432 | 1.801 | 0.986 | 1.647 | 0.574 | 0.465 | 1.350 | 1.311 |
| NbTa end | 6.115 | 0.595 | 3.282 | 1.575 | 2.593 | 0.663 | 3.227 | 1.601 | 2.928 | 0.958 | 0.652 | 2.559 | 2.388 |
| Nb+Ta | 0.122 | 0.012 | 0.066 | 0.032 | 0.052 | 0.013 | 0.065 | 0.032 | 0.059 | 0.019 | 0.013 | 0.051 | 0.048 |
| Fe+Mn | 0.066 | 0.007 | 0.035 | 0.015 | 0.031 | 0.009 | 0.036 | 0.020 | 0.033 | 0.011 | 0.009 | 0.027 | 0.026 |
| Comments: | AB & AC<br>same grain | | | | | | | | | | | CI & CJ<br>same grain | |

| | ZA | ZB | ZC | ZD | ZE | YE | YI | YJ | YK | TJ | BD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Marko's pegmatite** | | | | | **Marko's pegmatite** | | | | | **Marko's** |
| | 94-44C | | | | | 94-44C | | | | | 94-44D |
| SnO2 | 99.24 | 96.67 | 94.24 | 96.05 | 96.16 | 94.36 | 99.00 | 97.43 | 97.89 | 97.65 | 99.30 |
| FeO | 0.04 | 0.31 | 0.60 | 0.51 | 0.50 | 0.73 | 0.19 | 0.37 | 0.25 | 0.25 | 0.07 |
| MnO | 0.03 | 0.12 | 0.20 | 0.09 | 0.14 | 0.23 | 0.07 | 0.14 | 0.07 | 0.08 | 0.02 |
| Nb2O5 | 0.01 | 0.10 | 0.12 | 0.01 | 0.28 | 0.19 | 0.04 | 0.12 | 0.06 | 0.09 | 0.07 |
| Ta2O5 | 0.25 | 2.35 | 4.39 | 2.72 | 2.78 | 5.02 | 1.12 | 2.55 | 1.40 | 1.64 | 0.63 |
| Total | 99.57 | 99.55 | 99.55 | 99.38 | 99.86 | 100.53 | 100.42 | 100.61 | 99.67 | 99.71 | 100.09 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.994 | 1.948 | 1.904 | 1.940 | 1.931 | 1.889 | 1.974 | 1.943 | 1.968 | 1.962 | 1.985 |
| Fe | 0.002 | 0.013 | 0.025 | 0.022 | 0.021 | 0.031 | 0.008 | 0.015 | 0.011 | 0.011 | 0.003 |
| Mn | 0.001 | 0.005 | 0.009 | 0.004 | 0.006 | 0.010 | 0.003 | 0.006 | 0.003 | 0.003 | 0.001 |
| Nb | 0.000 | 0.002 | 0.003 | 0.000 | 0.006 | 0.004 | 0.001 | 0.003 | 0.001 | 0.002 | 0.00 |
| Ta | 0.003 | 0.032 | 0.060 | 0.037 | 0.038 | 0.069 | 0.015 | 0.035 | 0.019 | 0.022 | 0.009 |
| Total | 2.001 | 2.000 | 2.001 | 2.003 | 2.002 | 2.002 | 2.001 | 2.001 | 2.002 | 2.001 | 1.999 |
| Sn end | 99.669 | 97.360 | 95.141 | 96.847 | 96.431 | 94.342 | 98.648 | 97.063 | 98.297 | 98.077 | 99.288 |
| FeMn end | 0.148 | 0.912 | 1.699 | 1.271 | 1.350 | 2.019 | 0.545 | 1.069 | 0.676 | 0.697 | 0.200 |
| NbTa end | 0.183 | 1.728 | 3.160 | 1.882 | 2.220 | 3.638 | 0.806 | 1.868 | 1.027 | 1.226 | 0.512 |
| Nb+Ta | 0.004 | 0.035 | 0.063 | 0.038 | 0.044 | 0.073 | 0.016 | 0.037 | 0.021 | 0.025 | 0.010 |
| Fe+Mn | 0.003 | 0.018 | 0.034 | 0.025 | 0.027 | 0.040 | 0.011 | 0.021 | 0.014 | 0.014 | 0.004 |
| Comments: | | ZA - ZE | | | | contains | | | | | |
| | | same grain | | | core | a single | | | | | |
| | ZA - ZE are from an inclusion-free grain | | | | | wodginite | | | | | |
| | | | | | | inclusion | | | | | |

| | Marko's pegmatite | | | | | | | Marko's peg. | | Marko's peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44E | | | | | | | 94-44G | | 94-44I | |
| | HC | PE | PF | PJ | PK | PO | PQ | BF | BG | XF | XG |
| SnO2 | 97.49 | 98.65 | 98.76 | 99.45 | 97.39 | 94.12 | 98.30 | 99.91 | 97.99 | 98.80 | 99.20 |
| FeO | 0.31 | 0.13 | 0.13 | 0.05 | 0.27 | 0.57 | 0.12 | 0.11 | 0.17 | 0.23 | 0.12 |
| MnO | 0.08 | 0.08 | 0.03 | 0.07 | 0.07 | 0.16 | 0.07 | 0.07 | 0.08 | 0.05 | 0.05 |
| Nb2O5 | 0.01 | 0.00 | 0.07 | 0.03 | 0.06 | 0.06 | 0.07 | 0.07 | 0.13 | 0.18 | 0.01 |
| Ta2O5 | 1.65 | 0.93 | 0.85 | 0.48 | 1.55 | 3.58 | 0.73 | 0.43 | 0.60 | 0.81 | 0.22 |
| Total | 99.54 | 99.79 | 99.84 | 100.08 | 99.34 | 98.49 | 99.29 | 100.59 | 98.97 | 100.07 | 99.60 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.963 | 1.980 | 1.980 | 1.988 | 1.964 | 1.920 | 1.981 | 1.987 | 1.981 | 1.975 | 1.992 |
| Fe | 0.013 | 0.005 | 0.005 | 0.002 | 0.011 | 0.024 | 0.005 | 0.005 | 0.007 | 0.010 | 0.005 |
| Mn | 0.003 | 0.003 | 0.001 | 0.003 | 0.003 | 0.007 | 0.003 | 0.003 | 0.003 | 0.002 | 0.002 |
| Nb | 0.000 | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.004 | 0.000 |
| Ta | 0.023 | 0.013 | 0.012 | 0.007 | 0.021 | 0.050 | 0.010 | 0.006 | 0.008 | 0.011 | 0.003 |
| Total | 2.003 | 2.001 | 2.000 | 2.001 | 2.002 | 2.003 | 2.001 | 2.002 | 2.003 | 2.002 | 2.003 |
| Sn end | 98.032 | 98.920 | 99.002 | 99.385 | 98.146 | 95.879 | 99.015 | 99.253 | 98.907 | 98.657 | 99.479 |
| FeMn end | 0.825 | 0.444 | 0.337 | 0.253 | 0.721 | 1.564 | 0.403 | 0.377 | 0.531 | 0.588 | 0.359 |
| NbTa end | 1.143 | 0.636 | 0.661 | 0.361 | 1.134 | 2.557 | 0.581 | 0.370 | 0.562 | 0.755 | 0.162 |
| Nb+Ta | 0.023 | 0.013 | 0.013 | 0.007 | 0.023 | 0.051 | 0.012 | 0.007 | 0.011 | 0.015 | 0.003 |
| Fe+Mn | 0.017 | 0.009 | 0.007 | 0.005 | 0.014 | 0.031 | 0.008 | 0.008 | 0.011 | 0.012 | 0.007 |
| Comments: | | core | rim | | | | | BF & BG | | XF & XG | |
| | some cassiterite occurs as inclusions in microlite | | | | | | | same grain | | same grain | |
| | | | | | | | | close association | | wodginite incls. | |
| | | | | | | | | with Mn columbite | | | |

& garnet

**Marko's pegmatite**

94-44J

| | SD | SF | SG | SH | SJ | YC | YD | YE | YF | YG |
|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 98.71 | 99.54 | 98.78 | 99.65 | 99.67 | 98.49 | 97.73 | 98.98 | 98.88 | 99.24 |
| FeO | 0.17 | 0.11 | 0.15 | 0.12 | 0.06 | 0.20 | 0.14 | 0.14 | 0.15 | 0.09 |
| MnO | 0.05 | 0.05 | 0.04 | 0.07 | 0.04 | 0.04 | 0.05 | 0.03 | 0.03 | 0.03 |
| Nb2O5 | 0.07 | 0.01 | 0.03 | 0.04 | 0.00 | 0.09 | 0.04 | 0.04 | 0.07 | 0.01 |
| Ta2O5 | 0.75 | 0.52 | 0.73 | 0.61 | 0.37 | 0.88 | 0.78 | 0.45 | 0.85 | 0.36 |
| Total | 99.75 | 100.23 | 99.73 | 100.49 | 100.14 | 99.70 | 98.74 | 99.64 | 99.98 | 99.73 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.981 | 1.988 | 1.983 | 1.985 | 1.992 | 1.977 | 1.981 | 1.988 | 1.980 | 1.991 |
| Fe | 0.007 | 0.005 | 0.006 | 0.005 | 0.003 | 0.008 | 0.006 | 0.006 | 0.006 | 0.004 |
| Mn | 0.002 | 0.002 | 0.002 | 0.003 | 0.002 | 0.002 | 0.002 | 0.001 | 0.001 | 0.001 |
| Nb | 0.002 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.001 | 0.002 | 0.000 |
| Ta | 0.010 | 0.007 | 0.010 | 0.008 | 0.005 | 0.012 | 0.011 | 0.006 | 0.012 | 0.005 |
| Total | 2.002 | 2.002 | 2.001 | 2.002 | 2.001 | 2.002 | 2.001 | 2.002 | 2.000 | 2.001 |
| Sn end | 98.944 | 99.299 | 99.066 | 99.143 | 99.537 | 98.790 | 99.010 | 99.288 | 98.962 | 99.489 |
| FeMn end | 0.464 | 0.336 | 0.401 | 0.398 | 0.211 | 0.506 | 0.405 | 0.358 | 0.379 | 0.253 |
| NbTa end | 0.592 | 0.365 | 0.533 | 0.459 | 0.252 | 0.704 | 0.585 | 0.353 | 0.660 | 0.258 |
| Nb+Ta | 0.012 | 0.007 | 0.011 | 0.009 | 0.005 | 0.014 | 0.012 | 0.007 | 0.013 | 0.005 |
| Fe+Mn | 0.009 | 0.007 | 0.008 | 0.008 | 0.004 | 0.010 | 0.008 | 0.007 | 0.008 | 0.005 |

Comments: SD - SJ large grain containing
titanowodginite and ferrotitanowodginite inclusions
euhedral antimonian microlite attached

**Marko's pegmatite**

94-44K

| | CE | CI | ZA | ZD | ZI | HA | HB | HC | HD | HE |
|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 95.60 | 98.10 | 92.92 | 99.18 | 97.53 | 95.77 | 98.13 | 95.82 | 97.96 | 94.46 |
| FeO | 0.57 | 0.14 | 0.87 | 0.05 | 0.08 | 0.57 | 0.43 | 0.86 | 0.21 | 0.71 |
| MnO | 0.07 | 0.01 | 0.10 | 0.01 | 0.04 | 0.11 | 0.12 | 0.09 | 0.11 | 0.15 |
| Nb2O5 | 0.58 | 0.03 | 0.80 | 0.03 | 0.12 | 0.87 | 0.38 | 0.74 | 0.40 | 0.74 |
| Ta2O5 | 2.71 | 0.66 | 3.70 | 0.12 | 0.49 | 2.61 | 1.15 | 2.73 | 1.37 | 3.60 |
| Total | 99.53 | 98.94 | 98.39 | 99.39 | 98.26 | 99.93 | 100.21 | 100.24 | 100.05 | 99.66 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.923 | 1.985 | 1.892 | 1.996 | 1.985 | 1.917 | 1.958 | 1.913 | 1.959 | 1.899 |
| Fe | 0.024 | 0.006 | 0.037 | 0.002 | 0.003 | 0.024 | 0.018 | 0.036 | 0.009 | 0.030 |
| Mn | 0.003 | 0.000 | 0.004 | 0.000 | 0.002 | 0.005 | 0.005 | 0.004 | 0.005 | 0.006 |
| Nb | 0.013 | 0.001 | 0.018 | 0.001 | 0.003 | 0.020 | 0.009 | 0.017 | 0.009 | 0.017 |
| Ta | 0.037 | 0.009 | 0.051 | 0.002 | 0.007 | 0.036 | 0.016 | 0.037 | 0.019 | 0.049 |
| Total | 2.001 | 2.001 | 2.003 | 2.001 | 2.000 | 2.000 | 2.005 | 2.006 | 2.000 | 2.002 |
| Sn end | 96.129 | 99.192 | 94.443 | 99.757 | 99.264 | 95.803 | 97.640 | 95.328 | 97.938 | 94.876 |
| FeMn end | 1.352 | 0.318 | 2.070 | 0.127 | 0.257 | 1.430 | 1.151 | 1.985 | 0.674 | 1.816 |
| NbTa end | 2.520 | 0.490 | 3.487 | 0.117 | 0.479 | 2.767 | 1.209 | 2.687 | 1.388 | 3.309 |
| Nb+Ta | 0.050 | 0.010 | 0.070 | 0.002 | 0.010 | 0.055 | 0.024 | 0.054 | 0.028 | 0.066 |
| Fe+Mn | 0.027 | 0.006 | 0.041 | 0.003 | 0.005 | 0.029 | 0.023 | 0.040 | 0.013 | 0.036 |
| Comments: | All from one big grain | | | light colour | | | | HA - HE same grain | | |
| | dark colour = high Ta | | | edge of | | | | | | |
| | | | | big crystal | | | | | | |

**Marko's pegmatite**

94-44M

| | IA | IB | IC | ID | IE | LB | LG | LH | LI | LM | LN | LO |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 100.07 | 99.83 | 96.47 | 99.67 | 99.41 | 99.13 | 99.54 | 97.64 | 98.95 | 99.68 | 97.46 | 96.90 |
| FeO | 0.17 | 0.17 | 0.62 | 0.14 | 0.20 | 0.24 | 0.19 | 0.29 | 0.13 | 0.15 | 0.45 | 0.62 |
| MnO | 0.08 | 0.09 | 0.14 | 0.07 | 0.05 | 0.01 | 0.03 | 0.05 | 0.03 | 0.05 | 0.05 | 0.12 |
| Nb2O5 | 0.00 | 0.06 | 0.34 | 0.01 | 0.06 | 0.06 | 0.06 | 0.47 | 0.03 | 0.04 | 0.44 | 0.50 |
| Ta2O5 | 0.49 | 0.70 | 3.02 | 0.76 | 0.67 | 1.03 | 0.63 | 0.82 | 0.58 | 0.85 | 1.58 | 2.46 |
| Total | 100.81 | 100.85 | 100.59 | 100.65 | 100.39 | 100.47 | 100.45 | 99.27 | 99.72 | 100.77 | 99.98 | 100.60 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.986 | 1.981 | 1.923 | 1.982 | 1.982 | 1.976 | 1.983 | 1.965 | 1.986 | 1.980 | 1.950 | 1.929 |
| Fe | 0.007 | 0.007 | 0.026 | 0.006 | 0.008 | 0.010 | 0.008 | 0.012 | 0.005 | 0.006 | 0.019 | 0.026 |
| Mn | 0.003 | 0.004 | 0.006 | 0.003 | 0.002 | 0.000 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.005 |
| Nb | 0.000 | 0.001 | 0.008 | 0.000 | 0.001 | 0.001 | 0.001 | 0.011 | 0.001 | 0.001 | 0.010 | 0.011 |
| Ta | 0.007 | 0.009 | 0.041 | 0.010 | 0.009 | 0.014 | 0.009 | 0.011 | 0.008 | 0.012 | 0.022 | 0.033 |
| Total | 2.004 | 2.003 | 2.004 | 2.002 | 2.003 | 2.001 | 2.002 | 2.002 | 2.001 | 2.001 | 2.003 | 2.004 |
| Sn end | 99.147 | 98.917 | 95.978 | 99.034 | 98.954 | 98.710 | 99.045 | 98.183 | 99.232 | 98.962 | 97.376 | 96.227 |
| FeMn end | 0.522 | 0.543 | 1.590 | 0.439 | 0.523 | 0.522 | 0.460 | 0.718 | 0.337 | 0.418 | 1.049 | 1.544 |
| NbTa end | 0.331 | 0.540 | 2.433 | 0.526 | 0.523 | 0.767 | 0.495 | 1.098 | 0.431 | 0.621 | 1.575 | 2.229 |
| Nb+Ta | 0.007 | 0.011 | 0.049 | 0.011 | 0.010 | 0.015 | 0.010 | 0.022 | 0.009 | 0.012 | 0.032 | 0.045 |
| Fe+Mn | 0.010 | 0.011 | 0.032 | 0.009 | 0.010 | 0.010 | 0.009 | 0.014 | 0.007 | 0.008 | 0.021 | 0.031 |

Comments: IA - IE same grain; many tiny inclusions. LB - LO same grain; inclusions have extreme ferrotitanowodginite composition

| | SF | SG | SH | SJ | SK | SL | SM | SO | SP | AI | AJ | AK | AN | AM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Marko's pegmatite** | | | | | | | | | **Marko's pegmatite** | | | | |
| | 94-44N1 | | | | | | | | | 94-44N1 | | | | |
| SnO2 | 98.30 | 96.85 | 99.22 | 98.26 | 99.19 | 98.99 | 99.61 | 99.83 | 98.05 | 93.19 | 99.75 | 97.25 | 97.16 | 96.33 |
| FeO | 0.39 | 0.49 | 0.24 | 0.38 | 0.34 | 0.34 | 0.22 | 0.20 | 0.37 | 0.73 | 0.18 | 0.39 | 0.48 | 0.39 |
| MnO | 0.08 | 0.11 | 0.08 | 0.09 | 0.03 | 0.08 | 0.04 | 0.05 | 0.12 | 0.19 | 0.07 | 0.07 | 0.14 | 0.04 |
| Nb2O5 | 0.82 | 0.82 | 0.69 | 0.84 | 0.31 | 0.31 | 0.19 | 0.12 | 0.48 | 0.45 | 0.03 | 0.34 | 0.25 | 0.18 |
| Ta2O5 | 1.07 | 1.71 | 0.72 | 1.35 | 0.91 | 0.88 | 0.90 | 0.57 | 1.76 | 4.30 | 0.78 | 2.09 | 2.66 | 1.98 |
| Total | 100.66 | 99.98 | 100.95 | 100.92 | 100.78 | 100.60 | 100.96 | 100.77 | 100.78 | 98.86 | 100.81 | 100.14 | 100.69 | 98.92 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.949 | 1.935 | 1.962 | 1.944 | 1.968 | 1.968 | 1.974 | 1.982 | 1.946 | 1.893 | 1.981 | 1.945 | 1.935 | 1.951 |
| Fe | 0.016 | 0.021 | 0.010 | 0.016 | 0.014 | 0.014 | 0.009 | 0.008 | 0.015 | 0.031 | 0.007 | 0.016 | 0.020 | 0.017 |
| Mn | 0.003 | 0.005 | 0.003 | 0.004 | 0.001 | 0.003 | 0.002 | 0.002 | 0.005 | 0.008 | 0.003 | 0.003 | 0.006 | 0.002 |
| Nb | 0.018 | 0.019 | 0.015 | 0.019 | 0.007 | 0.007 | 0.004 | 0.003 | 0.011 | 0.010 | 0.001 | 0.008 | 0.006 | 0.004 |
| Ta | 0.014 | 0.023 | 0.010 | 0.018 | 0.012 | 0.012 | 0.012 | 0.008 | 0.024 | 0.060 | 0.011 | 0.029 | 0.036 | 0.027 |
| Total | 2.002 | 2.002 | 2.000 | 2.001 | 2.003 | 2.004 | 2.001 | 2.003 | 2.002 | 2.002 | 2.002 | 2.001 | 2.003 | 2.001 |
| Sn end | 97.378 | 96.650 | 98.076 | 97.170 | 98.267 | 98.180 | 98.638 | 98.959 | 97.247 | 94.544 | 98.917 | 97.223 | 96.617 | 97.512 |
| FeMn end | 0.979 | 1.259 | 0.666 | 0.977 | 0.770 | 0.876 | 0.541 | 0.521 | 1.022 | 1.963 | 0.522 | 0.966 | 1.297 | 0.914 |
| NbTa end | 1.644 | 2.092 | 1.259 | 1.852 | 0.963 | 0.944 | 0.821 | 0.520 | 1.730 | 3.493 | 0.561 | 1.810 | 2.086 | 1.574 |
| Nb+Ta | 0.033 | 0.042 | 0.025 | 0.037 | 0.019 | 0.019 | 0.016 | 0.010 | 0.035 | 0.070 | 0.011 | 0.036 | 0.042 | 0.031 |
| Fe+Mn | 0.020 | 0.025 | 0.013 | 0.020 | 0.015 | 0.018 | 0.011 | 0.010 | 0.020 | 0.039 | 0.010 | 0.019 | 0.026 | 0.018 |
| Comments: | | SF - SJ<br>same grain<br>well developed zonation | | | | | SK - SP<br>same grain | | | core | light<br>coloured | | core | rim |
| | cassiterite occurs with acicular manganocolumbite and nanpingite | | | | | | | | | | | | | |

| | Marko's peg. | | Marko's pegmatite | | | | | | | Marko's pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 94-44P | | 94-44R | | | | | | | 94-44S | | |
| | CC | CK | DF | DK | DM | YJ | YN | YR | YS | DA | DB | DC |
| SnO2 | 99.66 | 98.70 | 96.41 | 96.12 | 96.68 | 96.66 | 98.35 | 96.69 | 97.79 | 99.46 | 100.00 | 99.29 |
| FeO | 0.13 | 0.25 | 0.46 | 0.38 | 0.47 | 0.45 | 0.21 | 0.53 | 0.33 | 0.06 | 0.06 | 0.07 |
| MnO | 0.04 | 0.09 | 0.19 | 0.14 | 0.16 | 0.18 | 0.09 | 0.12 | 0.14 | 0.05 | 0.05 | 0.07 |
| Nb2O5 | 0.00 | 0.09 | 0.15 | 0.09 | 0.13 | 0.12 | 0.07 | 0.13 | 0.10 | 0.01 | 0.01 | 0.00 |
| Ta2O5 | 0.89 | 1.71 | 3.14 | 3.04 | 3.36 | 2.88 | 1.58 | 3.35 | 2.10 | 0.49 | 0.43 | 0.57 |
| Total | 100.72 | 100.84 | 100.35 | 99.77 | 100.80 | 100.29 | 100.30 | 100.82 | 100.46 | 100.07 | 100.55 | 100.00 |
| | Structural formulae based on 4 oxygens | | | | | | | | | | | |
| Sn | 1.981 | 1.961 | 1.929 | 1.934 | 1.926 | 1.934 | 1.965 | 1.926 | 1.952 | 1.989 | 1.990 | 1.987 |
| Fe | 0.005 | 0.010 | 0.019 | 0.016 | 0.020 | 0.019 | 0.009 | 0.022 | 0.014 | 0.003 | 0.003 | 0.003 |
| Mn | 0.002 | 0.004 | 0.008 | 0.006 | 0.007 | 0.008 | 0.004 | 0.005 | 0.006 | 0.002 | 0.002 | 0.003 |
| Nb | 0.000 | 0.002 | 0.003 | 0.002 | 0.003 | 0.003 | 0.002 | 0.003 | 0.002 | 0.000 | 0.000 | 0.000 |
| Ta | 0.012 | 0.023 | 0.043 | 0.042 | 0.046 | 0.039 | 0.022 | 0.046 | 0.029 | 0.007 | 0.006 | 0.008 |
| Total | 2.001 | 2.001 | 2.002 | 2.000 | 2.001 | 2.003 | 2.001 | 2.001 | 2.002 | 2.001 | 2.001 | 2.001 |
| Sn end | 99.041 | 98.030 | 96.323 | 96.710 | 96.252 | 96.577 | 98.214 | 96.220 | 97.473 | 99.423 | 99.466 | 99.316 |
| FeMn end | 0.355 | 0.711 | 1.367 | 1.101 | 1.320 | 1.325 | 0.631 | 1.360 | 0.986 | 0.232 | 0.231 | 0.296 |
| NbTa end | 0.603 | 1.260 | 2.309 | 2.189 | 2.428 | 2.098 | 1.155 | 2.420 | 1.541 | 0.345 | 0.303 | 0.389 |
| Nb+Ta | 0.012 | 0.025 | 0.046 | 0.044 | 0.049 | 0.042 | 0.023 | 0.048 | 0.031 | 0.007 | 0.006 | 0.008 |
| Fe+Mn | 0.007 | 0.014 | 0.027 | 0.022 | 0.026 | 0.027 | 0.013 | 0.027 | 0.020 | 0.005 | 0.005 | 0.006 |
| Comments: | CC & CK | | | | | | colourless | brown | brown | | DA - DC | |
| | same grain | | | | | associated with manganotantalite & microlite | | | | | same grain | |
| | euhedral | | | | | | | | | | contains a few tiny inclusions | |
| | later than | | | | | | | | | | associated with wodginite | |

wodginite

| | Marko's pegmatite 94-44U | | | | | | | | Marko's pegmatite 94-44W | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | AK | AN | XA | XB | XC | XD | XE | XF | FB | FC | FD | FH |
| SnO2 | 99.31 | 98.97 | 99.20 | 98.32 | 97.95 | 98.13 | 97.22 | 99.13 | 92.65 | 97.26 | 94.47 | 99.19 |
| FeO | 0.13 | 0.13 | 0.11 | 0.15 | 0.20 | 0.18 | 0.26 | 0.10 | 0.99 | 0.33 | 0.73 | 0.14 |
| MnO | 0.04 | 0.05 | 0.00 | 0.01 | 0.03 | 0.00 | 0.09 | 0.00 | 0.24 | 0.15 | 0.19 | 0.04 |
| Nb2O5 | 0.07 | 0.03 | 0.05 | 0.13 | 0.08 | 0.39 | 0.22 | 0.05 | 0.91 | 0.27 | 0.70 | 0.03 |
| Ta2O5 | 0.63 | 0.88 | 0.80 | 1.15 | 1.23 | 0.78 | 1.76 | 0.66 | 5.24 | 2.26 | 3.75 | 0.79 |
| Total | 100.18 | 100.06 | 100.16 | 99.75 | 99.48 | 99.49 | 99.55 | 99.93 | 100.03 | 100.27 | 99.84 | 100.19 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.982 | 1.979 | 1.983 | 1.974 | 1.972 | 1.972 | 1.956 | 1.985 | 1.859 | 1.944 | 1.896 | 1.982 |
| Fe | 0.005 | 0.005 | 0.005 | 0.006 | 0.008 | 0.008 | 0.011 | 0.004 | 0.042 | 0.014 | 0.031 | 0.006 |
| Mn | 0.006 | 0.006 | 0.000 | 0.000 | 0.001 | 0.000 | 0.004 | 0.000 | 0.010 | 0.006 | 0.008 | 0.002 |
| Nb | 0.002 | 0.001 | 0.001 | 0.003 | 0.002 | 0.009 | 0.005 | 0.001 | 0.021 | 0.006 | 0.016 | 0.001 |
| Ta | 0.009 | 0.012 | 0.011 | 0.016 | 0.017 | 0.011 | 0.024 | 0.009 | 0.072 | 0.031 | 0.051 | 0.011 |
| Total | 2.003 | 2.002 | 1.999 | 1.999 | 2.000 | 1.999 | 2.000 | 2.000 | 2.003 | 2.001 | 2.003 | 2.001 |
| Sn end | 98.946 | 98.819 | 99.165 | 98.746 | 98.586 | 98.640 | 97.800 | 99.294 | 92.797 | 97.145 | 94.701 | 99.050 |
| FeMn end | 0.547 | 0.548 | 0.239 | 0.325 | 0.478 | 0.375 | 0.737 | 0.206 | 2.590 | 1.010 | 1.939 | 0.378 |
| NbTa end | 0.507 | 0.633 | 0.596 | 0.929 | 0.936 | 0.985 | 1.463 | 0.500 | 4.613 | 1.845 | 3.359 | 0.572 |
| Nb+Ta | 0.010 | 0.013 | 0.012 | 0.019 | 0.019 | 0.020 | 0.029 | 0.010 | 0.092 | 0.037 | 0.067 | 0.011 |
| Fe+Mn | 0.011 | 0.011 | 0.005 | 0.006 | 0.010 | 0.008 | 0.015 | 0.004 | 0.052 | 0.020 | 0.039 | 0.008 |
| Comments: | AK & AN<br>same grain<br>contains many<br>tiny inclusions | | XA - XC<br>same grain<br>manganocolumbite-rich sample | | | | XE & XF<br>same grain | | FB - FD same grain<br>manganocolumbite-rich sample<br>some occurring as inclusions<br>in cassiterite | | | |

| | **Marko's pegmatite** | | | | **Marko's** | **Pegmatite 5** | |
|---|---|---|---|---|---|---|---|
| | 94-44Y | | | | 94-44ii | 94-80A | |
| | UE | UF | UH | UJ | EE | TF | TG |
| SnO2 | 95.49 | 94.12 | 91.20 | 99.23 | 98.48 | 96.74 | 95.30 |
| FeO | 0.83 | 0.77 | 1.32 | 0.21 | 0.38 | 0.40 | 0.68 |
| MnO | 0.12 | 0.08 | 0.08 | 0.07 | 0.08 | 0.03 | 0.05 |
| Nb2O5 | 0.44 | 0.39 | 0.70 | 0.07 | 0.21 | 0.37 | 0.46 |
| Ta2O5 | 3.42 | 4.08 | 6.30 | 0.76 | 1.77 | 1.28 | 3.16 |
| Total | 100.30 | 99.44 | 99.60 | 100.34 | 100.92 | 98.82 | 99.65 |
| | **Structural formulae based on 4 oxygens** | | | | | | |
| Sn | 1.909 | 1.901 | 1.842 | 1.979 | 1.955 | 1.958 | 1.917 |
| Fe | 0.035 | 0.033 | 0.056 | 0.009 | 0.016 | 0.017 | 0.029 |
| Mn | 0.005 | 0.003 | 0.003 | 0.003 | 0.003 | 0.001 | 0.002 |
| Nb | 0.010 | 0.009 | 0.016 | 0.002 | 0.005 | 0.008 | 0.010 |
| Ta | 0.047 | 0.056 | 0.087 | 0.010 | 0.024 | 0.018 | 0.043 |
| Total | 2.006 | 2.002 | 2.004 | 2.003 | 2.002 | 2.003 | 2.002 |
| Sn end | 95.188 | 94.946 | 91.909 | 98.8[illegible]8 | 97.609 | 97.781 | 95.770 |
| FeMn end | 1.989 | 1.801 | 2.961 | 0.587 | 0.958 | 0.912 | 1.540 |
| NbTa end | 2.822 | 3.253 | 5.130 | 0.595 | 1.432 | 1.306 | 2.690 |
| Nb+Ta | 0.057 | 0.065 | 0.103 | 0.012 | 0.029 | 0.026 | 0.054 |
| Fe+Mn | 0.040 | 0.036 | 0.059 | 0.012 | 0.019 | 0.018 | 0.031 |
| Comments: | UE & UF same grain | | perfectly euhedral crystal | | complex cassiterite wodginite microlite | TF & TG same grain | |

grain

|  | Pegmatite 5 |  |  |  |  | Pegmatite 5 |  |  |  |
|---|---|---|---|---|---|---|---|---|---|
|  | 94-80B |  |  |  |  | 94-80C |  |  |  |
|  | LA | LB | LC | LD | LE | XF | XG | XH | XI |
| SnO2 | 96.20 | 97.61 | 97.29 | 95.51 | 97.29 | 96.25 | 96.42 | 98.25 | 98.56 |
| FeO | 0.53 | 0.27 | 0.41 | 0.58 | 0.35 | 0.50 | 0.40 | 0.20 | 0.31 |
| MnO | 0.03 | 0.05 | 0.05 | 0.04 | 0.01 | 0.05 | 0.01 | 0.01 | 0.05 |
| Nb2O5 | 0.49 | 0.24 | 0.47 | 0.55 | 0.38 | 0.24 | 0.35 | 0.16 | 0.25 |
| Ta2O5 | 2.10 | 1.16 | 1.49 | 2.03 | 1.52 | 2.29 | 1.57 | 0.76 | 1.16 |
| Total | 99.35 | 99.33 | 99.71 | 98.71 | 99.55 | 99.33 | 98.75 | 99.38 | 100.33 |
|  | **Structural formulae based on 4 oxygens** |  |  |  |  |  |  |  |  |
| Sn | 1.938 | 1.966 | 1.951 | 1.936 | 1.956 | 1.942 | 1.954 | 1.978 | 1.966 |
| Fe | 0.022 | 0.011 | 0.017 | 0.025 | 0.015 | 0.021 | 0.017 | 0.008 | 0.013 |
| Mn | 0.001 | 0.002 | 0.002 | 0.002 | 0.000 | 0.002 | 0.000 | 0.000 | 0.002 |
| Nb | 0.011 | 0.005 | 0.011 | 0.013 | 0.009 | 0.005 | 0.008 | 0.004 | 0.006 |
| Ta | 0.029 | 0.016 | 0.020 | 0.028 | 0.021 | 0.032 | 0.022 | 0.010 | 0.016 |
| Total | 2.002 | 2.001 | 2.002 | 2.003 | 2.000 | 2.002 | 2.001 | 2.001 | 2.002 |
| Sn end | 96.817 | 98.253 | 97.480 | 96.651 | 97.766 | 96.988 | 97.643 | 98.853 | 98.176 |
| FeMn end | 1.183 | 0.677 | 0.968 | 1.317 | 0.759 | 1.164 | 0.871 | 0.443 | 0.753 |
| NbTa end | 2.001 | 1.070 | 1.552 | 2.032 | 1.475 | 1.848 | 1.486 | 0.704 | 1.070 |
| Nb+Ta | 0.040 | 0.021 | 0.031 | 0.041 | 0.029 | 0.037 | 0.030 | 0.014 | 0.021 |
| Fe+Mn | 0.024 | 0.014 | 0.019 | 0.026 | 0.015 | 0.023 | 0.017 | 0.009 | 0.015 |
| Comments: |  |  | LA - LE same grain |  |  |  | XF - XI same grain |  |  |
|  |  |  | core |  |  |  |  |  | core |

**Pegmatite 5**

94-80E

| | ME | MI | MQ | YK | YL | ZA | ZB | ZC | ZD | ZE | QD |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 98.98 | 99.14 | 99.25 | 99.08 | 88.04 | 87.28 | 85.97 | 88.58 | 87.04 | 87.42 | 85.01 |
| FeO | 0.38 | 0.26 | 0.27 | 0.28 | 1.88 | 1.88 | 1.98 | 1.66 | 1.80 | 1.84 | 1.88 |
| MnO | 0.04 | 0.04 | 0.04 | 0.00 | 0.08 | 0.10 | 0.08 | 0.06 | 0.08 | 0.10 | 0.05 |
| Nb2O5 | 0.09 | 0.07 | 0.07 | 0.07 | 0.95 | 1.04 | 1.06 | 0.95 | 0.94 | 0.86 | 0.99 |
| Ta2O5 | 1.49 | 1.01 | 0.97 | 1.44 | 9.99 | 10.20 | 11.04 | 9.31 | 9.91 | 9.82 | 10.92 |
| Total | 100.98 | 100.52 | 100.60 | 100.87 | 100.94 | 100.50 | 100.14 | 100.56 | 99.76 | 100.04 | 98.85 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.964 | 1.975 | 1.975 | 1.968 | 1.761 | 1.754 | 1.736 | 1.777 | 1.762 | 1.765 | 1.739 |
| Fe | 0.016 | 0.011 | 0.011 | 0.011 | 0.079 | 0.079 | 0.084 | 0.070 | 0.076 | 0.078 | 0.081 |
| Mn | 0.002 | 0.002 | 0.002 | 0.000 | 0.004 | 0.004 | 0.003 | 0.002 | 0.003 | 0.004 | 0.002 |
| Nb | 0.002 | 0.002 | 0.002 | 0.002 | 0.021 | 0.024 | 0.024 | 0.022 | 0.021 | 0.020 | 0.023 |
| Ta | 0.020 | 0.014 | 0.013 | 0.019 | 0.136 | 0.140 | 0.152 | 0.127 | 0.137 | 0.135 | 0.152 |
| Total | 2.003 | 2.002 | 2.003 | 2.000 | 2.002 | 2.001 | 2.000 | 1.999 | 2.000 | 2.002 | 1.998 |
| Sn end | 98.019 | 98.609 | 98.617 | 98.372 | 87.993 | 87.661 | 86.813 | 88.921 | 88.102 | 88.151 | 87.073 |
| FeMn end | 0.873 | 0.627 | 0.647 | 0.573 | 4.123 | 4.169 | 4.365 | 3.623 | 3.982 | 4.110 | 4.143 |
| NbTa end | 1.107 | 0.764 | 0.736 | 1.055 | 7.884 | 8.170 | 8.822 | 7.457 | 7.915 | 7.739 | 8.784 |
| Nb+Ta | 0.022 | 0.015 | 0.015 | 0.021 | 0.158 | 0.163 | 0.176 | 0.149 | 0.158 | 0.155 | 0.175 |
| Fe+Mn | 0.017 | 0.013 | 0.013 | 0.011 | 0.083 | 0.083 | 0.087 | 0.072 | 0.080 | 0.082 | 0.083 |
| Comments: | ME & MI same grain | | | associated with tungsteniferous wodginite | | ZA - ZE & QD - QW same grain cassiterite has zones containing many small inclusions (W wodginite) and others containing none | | | | | |

| | | | | | **Pegmatite 5** | | | | | | **Pegmatite 5** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 94-80E | | | | | | 94-80F | |
| | QT | QU | QV | QW | QI | QJ | QK | QL | PA | PB | ZA | ZB |
| SnO2 | 86.22 | 86.64 | 86.98 | 87.34 | 96.76 | 97.10 | 96.28 | 97.91 | 98.26 | 97.55 | 98.72 | 97.69 |
| FeO | 1.75 | 1.61 | 1.58 | 1.77 | 0.23 | 0.28 | 0.47 | 0.26 | 0.29 | 0.39 | 0.37 | 0.51 |
| MnO | 0.15 | 0.05 | 0.06 | 0.11 | 0.04 | 0.01 | 0.08 | 0.07 | 0.03 | 0.02 | 0.03 | 0.03 |
| Nb2O5 | 1.18 | 0.74 | 1.10 | 1.18 | 0.22 | 0.00 | 0.15 | 0.29 | 0.09 | 0.11 | 0.15 | 0.15 |
| Ta2O5 | 10.45 | 9.99 | 9.44 | 9.97 | 1.98 | 1.86 | 2.44 | 1.48 | 1.47 | 2.00 | 1.68 | 2.30 |
| Total | 99.74 | 99.03 | 99.16 | 100.38 | 99.22 | 99.24 | 99.41 | 100.01 | 100.14 | 100.08 | 100.95 | 100.68 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.746 | 1.769 | 1.769 | 1.756 | 1.954 | 1.962 | 1.942 | 1.960 | 1.966 | 1.954 | 1.959 | 1.945 |
| Fe | 0.074 | 0.069 | 0.068 | 0.075 | 0.010 | 0.012 | 0.020 | 0.011 | 0.012 | 0.017 | 0.015 | 0.021 |
| Mn | 0.006 | 0.002 | 0.003 | 0.005 | 0.002 | 0.001 | 0.003 | 0.003 | 0.001 | 0.001 | 0.001 | 0.001 |
| Nb | 0.027 | 0.017 | 0.025 | 0.027 | 0.005 | 0.000 | 0.003 | 0.007 | 0.002 | 0.002 | 0.003 | 0.003 |
| Ta | 0.144 | 0.139 | 0.131 | 0.137 | 0.027 | 0.026 | 0.034 | 0.020 | 0.020 | 0.027 | 0.023 | 0.031 |
| Total | 1.998 | 1.996 | 1.996 | 1.999 | 1.998 | 2.000 | 2.002 | 2.000 | 2.001 | 2.001 | 2.002 | 2.003 |
| Sn end | 87.390 | 88.620 | 88.647 | 87.837 | 97.813 | 98.102 | 96.998 | 97.978 | 98.230 | 97.633 | 97.863 | 97.144 |
| FeMn end | 4.037 | 3.552 | 3.520 | 3.975 | 0.573 | 0.619 | 1.160 | 0.682 | 0.668 | 0.878 | 0.832 | 1.127 |
| NbTa end | 8.573 | 7.828 | 7.833 | 8.189 | 1.614 | 1.279 | 1.842 | 1.340 | 1.103 | 1.489 | 1.304 | 1.729 |
| Nb+Ta | 0.171 | 0.156 | 0.156 | 0.164 | 0.032 | 0.026 | 0.037 | 0.027 | 0.022 | 0.030 | 0.026 | 0.035 |
| Fe+Mn | 0.081 | 0.071 | 0.070 | 0.079 | 0.011 | 0.012 | 0.023 | 0.014 | 0.013 | 0.018 | 0.017 | 0.023 |
| Comments: | QD - QW same grain<br>contains many tungsteniferous<br>wodginite inclusions<br>note very high Ta<br>contents of this grain | | | | QI - QL, PA & PB same grain<br>totally different to QE - QW cassiterite grain<br>many inclusions of wodginite,<br>but of lower W content | | | | | | ZA & ZB<br>same grain<br>associated<br>with<br>ferrowodginite | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | **Pegmatite 5** | | | | | **Pegmatite 5** | | |
| | | | | 94-80i | | | | | 94-80P | | |
| | RA | RB | RC | RD | QF | QG | QI | QJ | MA | MB | MC |
| SnO2 | 97.33 | 98.80 | 97.62 | 98.45 | 97.21 | 97.26 | 98.79 | 97.43 | 96.96 | 98.33 | 98.90 |
| FeO | 0.28 | 0.23 | 0.21 | 0.25 | 0.34 | 0.26 | 0.12 | 0.27 | 0.35 | 0.31 | 0.12 |
| MnO | 0.00 | 0.00 | 0.03 | 0.02 | 0.01 | 0.02 | 0.01 | 0.00 | 0.01 | 0.05 | 0.07 |
| Nb2O5 | 0.04 | 0.05 | 0.08 | 0.07 | 0.14 | 0.09 | 0.03 | 0.08 | 0.03 | 0.00 | 0.00 |
| Ta2O5 | 1.60 | 1.16 | 1.50 | 1.72 | 1.96 | 1.63 | 0.67 | 1.57 | 2.02 | 1.80 | 1.79 |
| Total | 99.25 | 100.24 | 99.44 | 100.50 | 99.66 | 99.26 | 99.61 | 99.35 | 99.37 | 100.49 | 100.88 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.965 | 1.974 | 1.967 | 1.963 | 1.955 | 1.963 | 1.985 | 1.965 | 1.957 | 1.962 | 1.966 |
| Fe | 0.012 | 0.010 | 0.009 | 0.011 | 0.014 | 0.011 | 0.005 | 0.011 | 0.015 | 0.013 | 0.005 |
| Mn | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.002 | 0.003 |
| Nb | 0.001 | 0.001 | 0.002 | 0.002 | 0.003 | 0.002 | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 |
| Ta | 0.022 | 0.016 | 0.021 | 0.023 | 0.027 | 0.022 | 0.009 | 0.022 | 0.028 | 0.025 | 0.024 |
| Total | 2.000 | 2.001 | 1.999 | 1.999 | 2.000 | 2.000 | 2.000 | 2.000 | 2.001 | 2.001 | 1.998 |
| Sn end | 98.255 | 98.666 | 98.373 | 98.190 | 97.764 | 98.188 | 99.248 | 98.253 | 97.809 | 98.027 | 98.382 |
| FeMn end | 0.592 | 0.487 | 0.503 | 0.564 | 0.730 | 0.583 | 0.261 | 0.578 | 0.775 | 0.748 | 0.407 |
| NbTa end | 1.153 | 0.847 | 1.123 | 1.246 | 1.506 | 1.230 | 0.490 | 1.169 | 1.416 | 1.225 | 1.212 |
| Nb+Ta | 0.023 | 0.017 | 0.022 | 0.025 | 0.030 | 0.025 | 0.010 | 0.023 | 0.028 | 0.025 | 0.024 |
| Fe+Mn | 0.012 | 0.010 | 0.010 | 0.011 | 0.015 | 0.012 | 0.005 | 0.012 | 0.015 | 0.015 | 0.008 |
| Comments: | | | | | | | QF - QJ<br>euhedral crystals<br>earlier than ferrotantalite | | | MA - MC same grain<br>half grain is wodginite | |

**Pegmatite 5**

94-80P

| | MG | MK | ML | MN | MO | MS | MU | MV | MZ | NB | NK | NN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 92.12 | 89.00 | 89.15 | 89.70 | 94.86 | 91.36 | 89.42 | 94.40 | 91.41 | 91.83 | 97.44 | 93.81 |
| FeO | 1.22 | 1.68 | 1.54 | 1.55 | 0.77 | 1.19 | 1.50 | 0.68 | 1.31 | 1.25 | 0.24 | 0.85 |
| MnO | 0.00 | 0.05 | 0.07 | 0.15 | 0.10 | 0.10 | 0.19 | 0.05 | 0.00 | 0.07 | 0.07 | 0.12 |
| Nb2O5 | 0.20 | 0.55 | 0.56 | 0.65 | 0.35 | 0.38 | 0.18 | 0.30 | 0.49 | 0.52 | 0.32 | 0.13 |
| Ta2O5 | 6.99 | 9.50 | 9.36 | 8.73 | 4.77 | 7.02 | 8.79 | 3.82 | 6.98 | 6.94 | 1.40 | 4.30 |
| | | | | | | | | | | | | |
| Total | 100.53 | 100.77 | 100.68 | 100.78 | 100.84 | 100.05 | 100.08 | 99.26 | 100.20 | 100.60 | 99.48 | 99.21 |
| | | | | | | | | | | | | |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.849 | 1.786 | 1.790 | 1.797 | 1.891 | 1.841 | 1.807 | 1.910 | 1.839 | 1.839 | 1.960 | 1.901 |
| Fe | 0.051 | 0.071 | 0.065 | 0.065 | 0.032 | 0.050 | 0.064 | 0.029 | 0.055 | 0.052 | 0.010 | 0.036 |
| Mn | 0.000 | 0.002 | 0.003 | 0.006 | 0.004 | 0.004 | 0.008 | 0.002 | 0.000 | 0.003 | 0.003 | 0.005 |
| Nb | 0.005 | 0.012 | 0.013 | 0.015 | 0.008 | 0.009 | 0.004 | 0.007 | 0.011 | 0.012 | 0.007 | 0.003 |
| Ta | 0.096 | 0.130 | 0.128 | 0.119 | 0.065 | 0.096 | 0.121 | 0.053 | 0.096 | 0.095 | 0.019 | 0.059 |
| | | | | | | | | | | | | |
| Total | 2.001 | 2.001 | 1.999 | 2.002 | 2.000 | 2.001 | 2.005 | 2.001 | 2.001 | 2.001 | 2.000 | 2.005 |
| | | | | | | | | | | | | |
| Sn end | 92.422 | 89.243 | 89.546 | 89.732 | 94.554 | 92.015 | 90.166 | 95.454 | 91.889 | 91.914 | 98.007 | 94.830 |
| FeMn end | 2.565 | 3.639 | 3.406 | 3.571 | 1.811 | 2.728 | 3.583 | 1.563 | 2.765 | 2.762 | 0.665 | 2.060 |
| NbTa end | 5.013 | 7.118 | 7.047 | 6.697 | 3.635 | 5.257 | 6.250 | 2.983 | 5.346 | 5.324 | 1.328 | 3.110 |
| | | | | | | | | | | | | |
| Nb+Ta | 0.100 | 0.142 | 0.141 | 0.134 | 0.073 | 0.105 | 0.125 | 0.060 | 0.107 | 0.107 | 0.027 | 0.062 |
| Fe+Mn | 0.051 | 0.073 | 0.068 | 0.071 | 0.036 | 0.055 | 0.072 | 0.031 | 0.055 | 0.055 | 0.013 | 0.041 |

Comments:

all grains carefully chosen away from wodginite

note high Ta contents

MU & MV
same grain

**Pegmatite 5**

94-80P

| | NT | NU | CJ | CK | CL | DE | DF | DG | DH | DI | DJ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 96.15 | 91.37 | 97.67 | 98.11 | 97.30 | 97.05 | 96.56 | 95.35 | 89.56 | 96.98 | 96.81 |
| FeO | 0.57 | 1.33 | 0.25 | 0.26 | 0.32 | 0.42 | 0.43 | 0.70 | 1.30 | 0.38 | 0.39 |
| MnO | 0.00 | 0.08 | 0.02 | 0.03 | 0.00 | 0.01 | 0.02 | 0.01 | 0.05 | 0.02 | 0.02 |
| Nb2O5 | 0.00 | 0.16 | 0.02 | 0.06 | 0.06 | 0.14 | 0.11 | 0.21 | 0.73 | 0.11 | 0.07 |
| Ta2O5 | 3.19 | 7.31 | 1.77 | 1.88 | 2.14 | 2.38 | 2.41 | 3.91 | 7.38 | 2.33 | 2.19 |
| | | | | | | | | | | | |
| Total | 99.92 | 100.26 | 99.73 | 100.34 | 99.83 | 100.00 | 99.53 | 100.18 | 99.03 | 99.82 | 99.48 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.933 | 1.840 | 1.958 | 1.960 | 1.955 | 1.946 | 1.946 | 1.912 | 1.822 | 1.948 | 1.952 |
| Fe | 0.024 | 0.056 | 0.011 | 0.011 | 0.014 | 0.018 | 0.018 | 0.029 | 0.056 | 0.016 | 0.017 |
| Mn | 0.000 | 0.004 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.001 | 0.001 |
| Nb | 0.000 | 0.004 | 0.000 | 0.001 | 0.001 | 0.003 | 0.002 | 0.005 | 0.017 | 0.002 | 0.002 |
| Ta | 0.044 | 0.100 | 0.024 | 0.026 | 0.029 | 0.033 | 0.033 | 0.054 | 0.102 | 0.032 | 0.030 |
| | | | | | | | | | | | |
| Total | 2.001 | 2.004 | 1.998 | 1.999 | 1.999 | 2.000 | 2.001 | 2.000 | 1.999 | 2.000 | 2.001 |
| | | | | | | | | | | | |
| Sn end | 96.602 | 91.821 | 98.185 | 98.050 | 97.776 | 97.297 | 97.274 | 95.597 | 91.139 | 97.429 | 97.546 |
| FeMn end | 1.211 | 2.980 | 0.582 | 0.598 | 0.692 | 0.916 | 0.948 | 1.489 | 2.894 | 0.850 | 0.867 |
| NbTa end | 2.186 | 5.199 | 1.233 | 1.353 | 1.532 | 1.787 | 1.778 | 2.914 | 5.967 | 1.722 | 1.587 |
| | | | | | | | | | | | |
| Nb+Ta | 0.044 | 0.104 | 0.025 | 0.027 | 0.031 | 0.036 | 0.036 | 0.058 | 0.119 | 0.034 | 0.032 |
| Fe+Mn | 0.024 | 0.060 | 0.012 | 0.012 | 0.014 | 0.018 | 0.019 | 0.030 | 0.058 | 0.017 | 0.017 |
| | | | | | | | | | | | |
| Comments: | NT & NU | | | CJ - CL | | | DE - DJ | | | | |
| | same grain | | | same grain | | | same grain | | close to | | |
| | | | | assoc. with W wodginite | | | mantles W wodginite | | W wodginite | | |

|  | Treelined Lake Complex |  |  |  |  | T.L.C. | Pegmatite 6 |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  | 94-84B |  |  |  |  | 94-84E | 94-90B |  |  |  |  |  |
|  | AA | AB | AC | AD | AE | ZA | HD | HI | HM | DH | DJ | DK |
| SnO2 | 97.83 | 98.57 | 98.20 | 98.31 | 97.97 | 97.56 | 88.07 | 88.44 | 87.93 | 94.39 | 87.24 | 87.54 |
| FeO | 0.32 | 0.23 | 0.25 | 0.24 | 0.22 | 0.42 | 1.73 | 1.78 | 1.69 | 0.81 | 1.80 | 1.72 |
| MnO | 0.03 | 0.00 | 0.02 | 0.03 | 0.02 | 0.02 | 0.07 | 0.08 | 0.09 | 0.04 | 0.04 | 0.06 |
| Nb2O5 | 0.33 | 0.22 | 0.23 | 0.24 | 0.25 | 0.07 | 1.19 | 1.31 | 1.19 | 0.43 | 1.17 | 1.22 |
| Ta2O5 | 1.48 | 1.15 | 1.18 | 1.24 | 1.20 | 2.38 | 8.68 | 8.63 | 8.63 | 4.40 | 9.09 | 8.80 |
| Total | 99.98 | 100.17 | 99.88 | 100.07 | 99.67 | 100.45 | 99.74 | 100.24 | 99.53 | 100.07 | 99.33 | 99.34 |
|  | **Structural formulae based on 4 oxygens** |  |  |  |  |  |  |  |  |  |  |  |
| Sn | 1.958 | 1.969 | 1.968 | 1.966 | 1.967 | 1.948 | 1.778 | 1.776 | 1.779 | 1.895 | 1.770 | 1.775 |
| Fe | 0.013 | 0.010 | 0.011 | 0.010 | 0.009 | 0.018 | 0.073 | 0.075 | 0.072 | 0.034 | 0.077 | 0.073 |
| Mn | 0.001 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.003 | 0.003 | 0.004 | 0.002 | 0.002 | 0.003 |
| Nb | 0.007 | 0.005 | 0.005 | 0.006 | 0.006 | 0.002 | 0.027 | 0.030 | 0.027 | 0.010 | 0.027 | 0.028 |
| Ta | 0.020 | 0.016 | 0.016 | 0.017 | 0.016 | 0.032 | 0.120 | 0.118 | 0.119 | 0.060 | 0.126 | 0.122 |
| Total | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.001 | 2.001 | 2.002 | 2.001 | 2.000 | 2.001 | 2.000 |
| Sn end | 97.887 | 98.486 | 98.362 | 98.304 | 98.378 | 97.379 | 88.855 | 88.694 | 88.908 | 94.708 | 88.464 | 88.727 |
| FeMn end | 0.731 | 0.488 | 0.570 | 0.573 | 0.510 | 0.922 | 3.811 | 3.914 | 3.777 | 1.788 | 3.910 | 3.787 |
| NbTa end | 1.382 | 1.026 | 1.068 | 1.123 | 1.112 | 1.699 | 7.334 | 7.392 | 7.315 | 3.504 | 7.626 | 7.485 |
| Nb+Ta | 0.028 | 0.021 | 0.021 | 0.022 | 0.022 | 0.034 | 0.147 | 0.148 | 0.146 | 0.070 | 0.153 | 0.150 |
| Fe+Mn | 0.015 | 0.010 | 0.011 | 0.011 | 0.010 | 0.018 | 0.076 | 0.078 | 0.076 | 0.036 | 0.078 | 0.076 |
| Comments: |  | AA - AC<br>same grain |  |  | few<br>small<br>inclusions |  |  |  | HD - DK same grain<br>associated with W wodginite<br>which is the dominant oxide<br>note high Ta contents |  |  |  |

| | East Beryl pegmatite | | | | | Pegmatite 9 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 94-304C | | | | | 94-318 | | | | |
| | KB | KF | KC | KD | KE | VC | VP | VR | MC | MF |
| SnO2 | 96.28 | 98.85 | 100.06 | 97.25 | 98.53 | 96.75 | 97.73 | 99.07 | 99.30 | 100.03 |
| FeO | 0.71 | 0.30 | 0.17 | 0.35 | 0.18 | 0.44 | 0.08 | 0.06 | 0.22 | 0.12 |
| MnO | 0.04 | 0.07 | 0.00 | 0.07 | 0.00 | 0.05 | 0.14 | 0.04 | 0.04 | 0.04 |
| Nb2O5 | 0.18 | 0.15 | 0.12 | 0.00 | 0.14 | 0.15 | 0.50 | 0.00 | 0.07 | 0.04 |
| Ta2O5 | 2.60 | 1.08 | 0.30 | 2.38 | 1.20 | 1.67 | 0.72 | 0.25 | 1.06 | 0.37 |
| Total | 99.81 | 100.44 | 100.65 | 100.05 | 100.05 | 99.06 | 99.17 | 99.42 | 100.69 | 100.60 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.935 | 1.970 | 1.988 | 1.950 | 1.972 | 1.957 | 1.969 | 1.994 | 1.975 | 1.989 |
| Fe | 0.030 | 0.013 | 0.007 | 0.015 | 0.007 | 0.019 | 0.003 | 0.003 | 0.009 | 0.005 |
| Mn | 0.001 | 0.003 | 0.000 | 0.003 | 0.000 | 0.002 | 0.006 | 0.002 | 0.002 | 0.002 |
| Nb | 0.004 | 0.003 | 0.003 | 0.000 | 0.003 | 0.003 | 0.011 | 0.000 | 0.002 | 0.001 |
| Ta | 0.036 | 0.015 | 0.004 | 0.033 | 0.016 | 0.023 | 0.010 | 0.003 | 0.014 | 0.005 |
| Total | 2.006 | 2.003 | 2.002 | 2.001 | 1.999 | 2.004 | 1.999 | 2.001 | 2.001 | 2.002 |
| Sn end | 96.452 | 98.332 | 99.309 | 97.478 | 98.648 | 97.640 | 98.465 | 99.617 | 98.660 | 99.370 |
| FeMn end | 1.566 | 0.774 | 0.360 | 0.893 | 0.370 | 1.038 | 0.469 | 0.212 | 0.543 | 0.334 |
| NbTa end | 1.982 | 0.894 | 0.331 | 1.629 | 0.982 | 1.321 | 1.066 | 0.171 | 0.797 | 0.296 |
| Nb+Ta | 0.040 | 0.018 | 0.007 | 0.033 | 0.020 | 0.026 | 0.021 | 0.003 | 0.016 | 0.006 |
| Fe+Mn | 0.031 | 0.016 | 0.007 | 0.018 | 0.007 | 0.021 | 0.009 | 0.004 | 0.011 | 0.007 |
| Comments: | ferrocolumbite inclusions in core region | | later columbite-free part | | | dark brown | medium brown | colourless | | adjacent to nigerite |

| | | | Pegmatite 7 | | | | | | | Pegmatite 7 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94-Peg 7A | | | | | | | 94-Peg 7B | | | | |
| | UH | UI | UK | UL | UM | QH | QI | QJ | QQ | QR | WR | WS | WT | WV |
| SnO2 | 96.84 | 96.57 | 99.58 | 99.46 | 98.36 | 99.51 | 99.56 | 97.48 | 98.83 | 99.99 | 99.45 | 98.99 | 99.29 | 96.35 |
| FeO | 0.58 | 0.63 | 0.15 | 0.18 | 0.31 | 0.21 | 0.15 | 0.47 | 0.31 | 0.13 | 0.22 | 0.13 | 0.25 | 0.53 |
| MnO | 0.04 | 0.03 | 0.03 | 0.07 | 0.01 | 0.05 | 0.03 | 0.05 | 0.05 | 0.03 | 0.05 | 0.03 | 0.05 | 0.01 |
| Nb2O5 | 0.38 | 0.49 | 0.06 | 0.04 | 0.22 | 0.03 | 0.09 | 0.43 | 0.19 | 0.09 | 0.03 | 0.09 | 0.10 | 0.40 |
| Ta2O5 | 2.27 | 2.35 | 0.73 | 0.82 | 1.28 | 0.88 | 0.72 | 1.79 | 1.35 | 0.52 | 0.80 | 0.45 | 1.06 | 2.21 |
| Total | 100.11 | 100.07 | 100.55 | 100.57 | 100.18 | 100.68 | 100.55 | 100.22 | 100.73 | 100.76 | 100.55 | 99.69 | 100.75 | 99.50 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.937 | 1.932 | 1.982 | 1.980 | 1.965 | 1.979 | 1.981 | 1.946 | 1.964 | 1.985 | 1.980 | 1.986 | 1.973 | 1.939 |
| Fe | 0.024 | 0.026 | 0.006 | 0.008 | 0.013 | 0.009 | 0.006 | 0.020 | 0.013 | 0.005 | 0.009 | 0.005 | 0.010 | 0.022 |
| Mn | 0.002 | 0.001 | 0.001 | 0.003 | 0.000 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 | 0.002 | 0.001 | 0.002 | 0.000 |
| Nb | 0.009 | 0.011 | 0.001 | 0.001 | 0.005 | 0.001 | 0.002 | 0.010 | 0.004 | 0.002 | 0.001 | 0.002 | 0.002 | 0.009 |
| Ta | 0.031 | 0.032 | 0.010 | 0.011 | 0.017 | 0.012 | 0.010 | 0.024 | 0.018 | 0.007 | 0.011 | 0.006 | 0.014 | 0.030 |
| Total | 2.003 | 2.003 | 2.001 | 2.002 | 2.001 | 2.002 | 2.001 | 2.002 | 2.002 | 2.001 | 2.003 | 2.001 | 2.002 | 2.002 |
| Sn end | 96.724 | 96.461 | 99.061 | 98.876 | 98.209 | 98.827 | 99.034 | 97.208 | 98.121 | 99.213 | 98.860 | 99.253 | 98.544 | 96.889 |
| FeMn end | 1.300 | 1.383 | 0.376 | 0.523 | 0.670 | 0.543 | 0.376 | 1.089 | 0.751 | 0.334 | 0.564 | 0.337 | 0.626 | 1.139 |
| NbTa end | 1.977 | 2.156 | 0.563 | 0.601 | 1.121 | 0.630 | 0.590 | 1.704 | 1.128 | 0.453 | 0.576 | 0.410 | 0.830 | 1.972 |
| Nb+Ta | 0.040 | 0.043 | 0.011 | 0.012 | 0.022 | 0.013 | 0.012 | 0.034 | 0.023 | 0.009 | 0.012 | 0.008 | 0.017 | 0.039 |
| Fe+Mn | 0.026 | 0.028 | 0.008 | 0.010 | 0.013 | 0.011 | 0.008 | 0.022 | 0.015 | 0.007 | 0.011 | 0.007 | 0.013 | 0.023 |
| Comments: | | UI - UM same grain | | core | | | abundant euhedral, zoned centimetre-sized crystals with U, Th, Pb inclusions | | | | | cassiterite crystallized later than wodginite | | |

| | | | Pegmatite 7 | | | | | Pegmatite 7 | | | | Pegmatite 7 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 94-Peg 7C | | | | | 94-Peg 7D | | | | 94-Peg 7X | | |
| | MA | MB | MC | MD | ME | XA | XB | XC | XD | XE | XD | XJ | XK | XL |
| SnO2 | 97.52 | 97.78 | 97.21 | 95.76 | 95.78 | 96.35 | 96.76 | 95.89 | 95.67 | 96.57 | 98.62 | 98.42 | 98.93 | 99.07 |
| FeO | 0.25 | 0.27 | 0.44 | 0.55 | 0.64 | 0.56 | 0.53 | 0.60 | 0.59 | 0.53 | 0.31 | 0.28 | 0.24 | 0.14 |
| MnO | 0.04 | 0.04 | 0.01 | 0.05 | 0.04 | 0.08 | 0.03 | 0.03 | 0.03 | 0.04 | 0.03 | 0.04 | 0.04 | 0.03 |
| Nb2O5 | 0.12 | 0.19 | 0.37 | 0.35 | 0.37 | 0.41 | 0.41 | 0.55 | 0.50 | 0.41 | 0.21 | 0.22 | 0.22 | 0.58 |
| Ta2O5 | 1.31 | 0.95 | 1.66 | 2.30 | 2.29 | 2.13 | 1.96 | 2.25 | 2.07 | 2.11 | 1.18 | 1.19 | 0.97 | 0.49 |
| Total | 99.24 | 99.23 | 99.69 | 99.01 | 99.12 | 99.53 | 99.69 | 99.32 | 98.86 | 99.66 | 100.35 | 100.15 | 100.40 | 100.31 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.968 | 1.972 | 1.952 | 1.938 | 1.936 | 1.938 | 1.943 | 1.932 | 1.937 | 1.940 | 1.967 | 1.967 | 1.971 | 1.972 |
| Fe | 0.011 | 0.011 | 0.019 | 0.023 | 0.027 | 0.024 | 0.022 | 0.025 | 0.025 | 0.022 | 0.013 | 0.012 | 0.010 | 0.006 |
| Mn | 0.002 | 0.002 | 0.000 | 0.002 | 0.002 | 0.003 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.002 | 0.002 | 0.001 |
| Nb | 0.003 | 0.004 | 0.008 | 0.008 | 0.008 | 0.009 | 0.009 | 0.013 | 0.011 | 0.009 | 0.005 | 0.005 | 0.005 | 0.013 |
| Ta | 0.018 | 0.013 | 0.023 | 0.032 | 0.032 | 0.029 | 0.027 | 0.031 | 0.029 | 0.029 | 0.016 | 0.016 | 0.013 | 0.007 |
| Total | 2.001 | 2.002 | 2.002 | 2.003 | 2.004 | 2.004 | 2.003 | 2.002 | 2.003 | 2.002 | 2.002 | 2.001 | 2.001 | 1.999 |
| Sn end | 98.347 | 98.475 | 97.497 | 96.742 | 96.564 | 96.725 | 97.015 | 96.498 | 96.685 | 96.889 | 98.250 | 98.269 | 98.507 | 98.657 |
| FeMn end | 0.614 | 0.656 | 0.947 | 1.273 | 1.439 | 1.350 | 1.178 | 1.330 | 1.315 | 1.200 | 0.711 | 0.671 | 0.586 | 0.356 |
| NbTa end | 1.038 | 0.869 | 1.556 | 1.986 | 1.998 | 1.925 | 1.806 | 2.172 | 2.000 | 1.910 | 1.039 | 1.059 | 0.907 | 0.988 |
| Nb+Ta | 0.021 | 0.017 | 0.031 | 0.040 | 0.040 | 0.039 | 0.036 | 0.043 | 0.040 | 0.038 | 0.021 | 0.021 | 0.018 | 0.020 |
| Fe+Mn | 0.012 | 0.013 | 0.019 | 0.025 | 0.029 | 0.027 | 0.024 | 0.027 | 0.026 | 0.024 | 0.014 | 0.013 | 0.012 | 0.007 |
| Comments: | | | MA - ME<br>same grain | | | | | XA - XE<br>same grain | | | | abundant euhedral, zoned<br>centimetre-sized crystals<br>with U, Th, Pb inclusions | | |

| | Peg. 11 | Pegmatite 11 | | | SW Be | Pegmatite 12 | | | | | | Pegmatite 12 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 95-117B | 95-117D | | | 96-11A | 96-13B | | | | | | 96-13C | | |
| | RN | TG | TH | TI | PJ | MH | MI | MJ | MK | ML | MM | NA | NB | NC |
| SnO2 | 98.64 | 98.19 | 97.45 | 98.11 | 92.21 | 99.59 | 99.41 | 99.48 | 97.31 | 98.74 | 99.31 | 99.32 | 99.64 | 99.32 |
| FeO | 0.16 | 0.16 | 0.36 | 0.30 | 1.15 | 0.01 | 0.03 | 0.01 | 0.05 | 0.02 | 0.02 | 0.06 | 0.04 | 0.04 |
| MnO | 0.01 | 0.00 | 0.06 | 0.05 | 0.02 | 0.00 | 0.02 | 0.00 | 0.20 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 |
| Nb2O5 | 0.17 | 0.20 | 0.65 | 0.47 | 0.15 | 0.02 | 0.05 | 0.00 | 0.23 | 0.04 | 0.00 | 0.00 | 0.03 | 0.05 |
| Ta2O5 | 0.75 | 0.54 | 1.07 | 0.58 | 6.18 | 0.12 | 0.24 | 0.13 | 1.92 | 0.26 | 0.07 | 0.34 | 0.23 | 0.21 |
| Total | 99.72 | 99.09 | 99.59 | 99.52 | 99.70 | 99.74 | 99.75 | 99.62 | 99.71 | 99.05 | 99.40 | 99.72 | 99.94 | 99.62 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.979 | 1.982 | 1.954 | 1.969 | 1.865 | 1.997 | 1.994 | 1.998 | 1.955 | 1.994 | 1.998 | 1.993 | 1.994 | 1.994 |
| Fe | 0.007 | 0.007 | 0.015 | 0.013 | 0.049 | 0.000 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.003 | 0.001 | 0.002 |
| Mn | 0.000 | 0.000 | 0.003 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.008 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 0.004 | 0.005 | 0.015 | 0.011 | 0.003 | 0.000 | 0.001 | 0.000 | 0.005 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
| Ta | 0.010 | 0.007 | 0.015 | 0.008 | 0.085 | 0.002 | 0.003 | 0.002 | 0.026 | 0.004 | 0.001 | 0.005 | 0.003 | 0.003 |
| Total | 2.000 | 2.000 | 2.001 | 2.003 | 2.003 | 2.000 | 2.000 | 2.000 | 1.997 | 1.999 | 2.000 | 2.000 | 2.000 | 2.000 |
| Sn end | 98.948 | 99.061 | 97.641 | 98.328 | 93.108 | 99.876 | 99.685 | 99.887 | 97.895 | 99.743 | 99.911 | 99.623 | 99.726 | 99.722 |
| FeMn end | 0.345 | 0.334 | 0.884 | 0.739 | 2.468 | 0.023 | 0.093 | 0.025 | 0.520 | 0.032 | 0.038 | 0.148 | 0.084 | 0.076 |
| NbTa end | 0.707 | 0.605 | 1.474 | 0.933 | 4.424 | 0.101 | 0.222 | 0.088 | 1.585 | 0.226 | 0.051 | 0.230 | 0.190 | 0.202 |
| Nb+Ta | 0.014 | 0.012 | 0.030 | 0.019 | 0.089 | 0.002 | 0.004 | 0.002 | 0.032 | 0.005 | 0.001 | 0.005 | 0.004 | 0.004 |
| Fe+Mn | 0.007 | 0.007 | 0.018 | 0.015 | 0.049 | 0.000 | 0.002 | 0.001 | 0.010 | 0.001 | 0.001 | 0.003 | 0.002 | 0.002 |
| Comments: | tiny<br>grain<br>assoc.<br>ferrocolumbite | TG - TI<br>same grain<br>contains many tiny inclusions | | | assoc. with<br>ferrotapiolite | MH & MI<br>same grain<br>tiny grains - ML has manganocolumbite inclusion | | MJ & MK<br>same grain | | ML & MM<br>same grain | | NA & NB<br>same grain | | |

| | | | SW Beryl pegmatite | | | | | SW Beryl pegmatite | | | | | SW Beryl aplite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 96-25A | | | | | 96-25B | | | | | 96-27 | | |
| | WA | WB | WC | WD | WE | XA | XB | XC | XD | XE | BA | BB | BE | BH | BI |
| SnO2 | 98.26 | 98.96 | 98.58 | 98.75 | 97.66 | 97.64 | 98.89 | 99.17 | 96.48 | 99.23 | 100.14 | 100.05 | 99.95 | 97.96 | 99.26 |
| FeO | 0.28 | 0.19 | 0.25 | 0.18 | 0.50 | 0.54 | 0.19 | 0.20 | 0.56 | 0.26 | 0.00 | 0.05 | 0.38 | 0.16 | 0.09 |
| MnO | 0.00 | 0.00 | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.01 | 0.08 | 0.16 | 0.06 |
| Nb2O5 | 0.77 | 0.25 | 0.11 | 0.14 | 0.76 | 1.15 | 0.35 | 0.10 | 0.94 | 0.34 | 0.00 | 0.00 | 0.03 | 1.19 | 0.42 |
| Ta2O5 | 0.60 | 0.77 | 1.12 | 0.92 | 0.76 | 1.26 | 0.53 | 0.92 | 1.41 | 0.45 | 0.17 | 0.00 | 0.10 | 0.89 | 0.69 |
| Total | 99.92 | 100.17 | 100.05 | 100.00 | 99.69 | 100.60 | 99.97 | 100.39 | 99.40 | 100.28 | 100.31 | 100.11 | 100.53 | 100.36 | 100.51 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Sn | 1.962 | 1.976 | 1.973 | 1.976 | 1.955 | 1.935 | 1.977 | 1.977 | 1.937 | 1.977 | 1.997 | 1.999 | 1.988 | 1.945 | 1.974 |
| Fe | 0.012 | 0.008 | 0.010 | 0.008 | 0.021 | 0.022 | 0.008 | 0.008 | 0.023 | 0.011 | 0.000 | 0.002 | 0.016 | 0.007 | 0.004 |
| Mn | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.003 | 0.007 | 0.002 |
| Nb | 0.017 | 0.006 | 0.003 | 0.003 | 0.017 | 0.026 | 0.008 | 0.002 | 0.021 | 0.008 | 0.000 | 0.000 | 0.001 | 0.027 | 0.009 |
| Ta | 0.008 | 0.010 | 0.015 | 0.013 | 0.010 | 0.017 | 0.007 | 0.013 | 0.019 | 0.006 | 0.002 | 0.000 | 0.001 | 0.012 | 0.009 |
| Total | 2.000 | 2.000 | 2.001 | 2.000 | 2.004 | 2.001 | 2.000 | 2.000 | 2.002 | 2.002 | 2.000 | 2.000 | 2.009 | 1.997 | 1.998 |
| Sn end | 98.124 | 98.797 | 98.595 | 98.821 | 97.531 | 96.707 | 98.834 | 98.847 | 96.759 | 98.769 | 99.882 | 99.882 | 98.968 | 97.384 | 98.752 |
| FeMn end | 0.601 | 0.398 | 0.514 | 0.388 | 1.098 | 1.155 | 0.409 | 0.410 | 1.208 | 0.541 | 0.000 | 0.118 | 0.936 | 0.669 | 0.315 |
| NbTa end | 1.274 | 0.806 | 0.891 | 0.790 | 1.371 | 2.138 | 0.757 | 0.743 | 2.034 | 0.690 | 0.118 | 0.000 | 0.095 | 1.947 | 0.934 |
| Nb+Ta | 0.025 | 0.016 | 0.018 | 0.016 | 0.027 | 0.043 | 0.015 | 0.015 | 0.041 | 0.014 | 0.002 | 0.000 | 0.002 | 0.039 | 0.019 |
| Fe+Mn | 0.012 | 0.008 | 0.010 | 0.008 | 0.022 | 0.023 | 0.008 | 0.008 | 0.024 | 0.011 | 0.000 | 0.002 | 0.019 | 0.013 | 0.006 |
| Comments: | | WA - WC<br>same grain<br>contains microlite inclusions | | WD & WE<br>same grain | | | XA - XC<br>same grain<br>contains a few tiny inclusions | | | | | | | BH & BI<br>same grain | |

| | **Big Whopper pegmatite** | | | | | **Big Whopper peg.** | | | **Big Whopper peg.** | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-29A | | | | | 96-29B | | | 96-29B | | | | |
| | JA | JB | JC | JD | CD | AF | AL | BK | BO | BP | BS | BT | BU |
| SnO2 | 97.73 | 98.15 | 98.11 | 99.25 | 97.10 | 99.38 | 98.81 | 99.75 | 93.13 | 98.96 | 96.32 | 100.28 | 100.33 |
| FeO | 0.21 | 0.06 | 0.01 | 0.06 | 0.36 | 0.10 | 0.16 | 0.04 | 0.19 | 0.00 | 0.14 | 0.01 | 0.21 |
| MnO | 0.02 | 0.14 | 0.06 | 0.00 | 0.06 | 0.01 | 0.00 | 0.04 | 0.67 | 0.12 | 0.33 | 0.01 | 0.00 |
| Nb2O5 | 0.19 | 0.32 | 0.09 | 0.08 | 0.23 | 0.07 | 0.30 | 0.25 | 1.29 | 0.11 | 0.42 | 0.00 | 0.00 |
| Ta2O5 | 1.50 | 1.57 | 1.07 | 0.32 | 1.89 | 0.69 | 0.44 | 0.24 | 5.19 | 0.91 | 3.28 | 0.33 | 0.04 |
| Total | 99.65 | 100.23 | 99.34 | 99.71 | 99.64 | 100.25 | 99.71 | 100.33 | 100.47 | 100.10 | 100.50 | 100.62 | 100.59 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.964 | 1.960 | 1.977 | 1.991 | 1.952 | 1.984 | 1.981 | 1.987 | 1.857 | 1.979 | 1.922 | 1.994 | 1.995 |
| Fe | 0.009 | 0.003 | 0.001 | 0.002 | 0.015 | 0.004 | 0.007 | 0.002 | 0.008 | 0.000 | 0.006 | 0.001 | 0.009 |
| Mn | 0.001 | 0.006 | 0.003 | 0.000 | 0.002 | 0.001 | 0.000 | 0.002 | 0.028 | 0.005 | 0.014 | 0.000 | 0.000 |
| Nb | 0.004 | 0.007 | 0.002 | 0.002 | 0.005 | 0.002 | 0.007 | 0.006 | 0.029 | 0.003 | 0.009 | 0.000 | 0.000 |
| Ta | 0.021 | 0.021 | 0.015 | 0.004 | 0.026 | 0.009 | 0.006 | 0.003 | 0.071 | 0.012 | 0.045 | 0.004 | 0.001 |
| Total | 1.999 | 1.997 | 1.997 | 2.000 | 2.001 | 2.000 | 2.000 | 1.999 | 1.993 | 1.999 | 1.996 | 1.999 | 2.004 |
| Sn end | 98.263 | 98.138 | 99.002 | 99.567 | 97.574 | 99.218 | 99.025 | 99.376 | 93.173 | 99.007 | 96.293 | 99.735 | 99.525 |
| FeMn end | 0.492 | 0.434 | 0.158 | 0.122 | 0.866 | 0.229 | 0.331 | 0.173 | 1.818 | 0.244 | 0.994 | 0.044 | 0.445 |
| NbTa end | 1.245 | 1.428 | 0.840 | 0.311 | 1.560 | 0.554 | 0.644 | 0.452 | 5.009 | 0.748 | 2.715 | 0.221 | 0.030 |
| Nb+Ta | 0.025 | 0.029 | 0.017 | 0.006 | 0.031 | 0.011 | 0.013 | 0.009 | 0.100 | 0.015 | 0.054 | 0.004 | 0.001 |
| Fe+Mn | 0.010 | 0.009 | 0.003 | 0.002 | 0.017 | 0.005 | 0.007 | 0.003 | 0.036 | 0.005 | 0.020 | 0.001 | 0.009 |
| Comments: | JA & JB<br>same grain | | JC & JD<br>same grain | | | | | | BO & BP<br>same grain | | | | |

**Big Whopper pegmatite**

96-29C

| | UA | UB | UC | UD | UE | DD | DE | DF | DR1 | DR2 | DR3 | DR4 | DR5 | DR6 | DR7 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $SnO_2$ | 93.59 | 97.75 | 98.02 | 96.79 | 95.08 | 99.59 | 100.57 | 99.42 | 93.70 | 93.82 | 93.99 | 93.49 | 94.64 | 95.88 | 94.46 |
| FeO | 0.19 | 0.07 | 0.05 | 0.10 | 0.13 | 0.01 | 0.00 | 0.00 | 0.14 | 0.12 | 0.14 | 0.14 | 0.14 | 0.12 | 0.16 |
| MnO | 0.63 | 0.16 | 0.11 | 0.24 | 0.34 | 0.03 | 0.00 | 0.00 | 0.55 | 0.56 | 0.53 | 0.58 | 0.40 | 0.33 | 0.44 |
| $Nb_2O_5$ | 1.05 | 0.81 | 0.68 | 0.74 | 0.81 | 0.35 | 0.00 | 0.00 | 0.91 | 0.88 | 0.86 | 0.84 | 0.96 | 0.86 | 0.84 |
| $Ta_2O_5$ | 4.77 | 1.19 | 0.85 | 2.10 | 2.97 | 0.21 | 0.12 | 0.17 | 4.42 | 4.24 | 4.16 | 4.57 | 3.44 | 2.87 | 3.78 |
| Total | 100.22 | 99.98 | 99.70 | 99.96 | 99.33 | 100.26 | 100.70 | 99.60 | 99.72 | 99.62 | 99.75 | 99.61 | 99.57 | 100.05 | 99.69 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.872 | 1.952 | 1.963 | 1.936 | 1.916 | 1.986 | 1.998 | 1.997 | 1.884 | 1.888 | 1.890 | 1.882 | 1.902 | 1.917 | 1.899 |
| Fe | 0.008 | 0.003 | 0.002 | 0.004 | 0.006 | 0.001 | 0.000 | 0.000 | 0.006 | 0.005 | 0.006 | 0.006 | 0.006 | 0.005 | 0.007 |
| Mn | 0.027 | 0.007 | 0.005 | 0.010 | 0.014 | 0.001 | 0.000 | 0.000 | 0.023 | 0.024 | 0.023 | 0.025 | 0.017 | 0.014 | 0.019 |
| Nb | 0.024 | 0.018 | 0.015 | 0.017 | 0.019 | 0.008 | 0.000 | 0.000 | 0.021 | 0.020 | 0.020 | 0.019 | 0.022 | 0.019 | 0.019 |
| Ta | 0.065 | 0.016 | 0.012 | 0.029 | 0.041 | 0.003 | 0.002 | 0.002 | 0.061 | 0.058 | 0.057 | 0.063 | 0.047 | 0.039 | 0.052 |
| Total | 1.995 | 1.996 | 1.997 | 1.996 | 1.995 | 1.998 | 2.000 | 2.000 | 1.994 | 1.995 | 1.995 | 1.995 | 1.994 | 1.995 | 1.995 |
| Sn end | 93.817 | 97.784 | 98.321 | 97.014 | 96.023 | 99.366 | 99.908 | 99.869 | 94.454 | 94.629 | 94.734 | 94.357 | 95.404 | 96.111 | 95.165 |
| FeMn end | 1.733 | 0.483 | 0.329 | 0.717 | 1.005 | 0.095 | 0.008 | 0.015 | 1.469 | 1.456 | 1.422 | 1.544 | 1.140 | 0.955 | 1.280 |
| NbTa end | 4.450 | 1.734 | 1.350 | 2.269 | 2.972 | 0.539 | 0.084 | 0.116 | 4.077 | 3.915 | 3.843 | 4.099 | 3.457 | 2.934 | 3.555 |
| Nb+Ta | 0.089 | 0.035 | 0.027 | 0.045 | 0.059 | 0.011 | 0.002 | 0.002 | 0.081 | 0.078 | 0.077 | 0.082 | 0.069 | 0.059 | 0.071 |
| Fe+Mn | 0.035 | 0.010 | 0.007 | 0.014 | 0.020 | 0.002 | 0.000 | 0.000 | 0.029 | 0.029 | 0.028 | 0.031 | 0.023 | 0.019 | 0.026 |

Comments:

UA - UE same grain

DD & DE same grain
brown colourless

DR = 1200 µm traverse from rim to core
of large euhedral crystal
note different Ta content compared to DD - DG

**Big Whopper pegmatite**

96-29D

| | LA | LB | LC | LF | LG | LH | LI | LJ | LK | RC | RD | RE | RF |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 96.04 | 100.12 | 99.37 | 90.88 | 97.94 | 97.97 | 97.74 | 99.95 | 96.41 | 99.29 | 98.90 | 97.61 | 97.87 |
| FeO | 0.03 | 0.01 | 0.01 | 0.04 | 0.17 | 0.15 | 0.01 | 0.02 | 0.01 | 0.03 | 0.07 | 0.01 | 0.28 |
| MnO | 0.34 | 0.01 | 0.05 | 1.03 | 0.08 | 0.13 | 0.20 | 0.01 | 0.27 | 0.01 | 0.01 | 0.09 | 0.00 |
| Nb2O5 | 0.83 | 0.01 | 0.19 | 0.99 | 0.08 | 0.24 | 0.99 | 0.00 | 1.17 | 0.05 | 0.06 | 0.93 | 0.35 |
| Ta2O5 | 2.48 | 0.06 | 0.55 | 7.01 | 1.74 | 1.60 | 1.39 | 0.14 | 1.84 | 0.11 | 0.30 | 0.52 | 1.08 |
| | | | | | | | | | | | | | |
| Total | 99.72 | 100.21 | 100.15 | 99.94 | 100.01 | 100.08 | 100.34 | 100.12 | 99.70 | 99.48 | 99.34 | 99.16 | 99.57 |
| | | | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.926 | 1.998 | 1.984 | 1.829 | 1.963 | 1.960 | 1.944 | 1.997 | 1.930 | 1.996 | 1.992 | 1.962 | 1.966 |
| Fe | 0.001 | 0.000 | 0.000 | 0.002 | 0.007 | 0.006 | 0.000 | 0.001 | 0.000 | 0.001 | 0.003 | 0.001 | 0.012 |
| Mn | 0.014 | 0.000 | 0.002 | 0.044 | 0.003 | 0.006 | 0.009 | 0.000 | 0.011 | 0.000 | 0.000 | 0.004 | 0.000 |
| Nb | 0.019 | 0.000 | 0.004 | 0.022 | 0.002 | 0.005 | 0.022 | 0.000 | 0.026 | 0.001 | 0.001 | 0.021 | 0.008 |
| Ta | 0.034 | 0.001 | 0.007 | 0.096 | 0.024 | 0.022 | 0.019 | 0.002 | 0.025 | 0.001 | 0.004 | 0.007 | 0.015 |
| | | | | | | | | | | | | | |
| Total | 1.995 | 2.000 | 1.998 | 1.993 | 1.999 | 1.999 | 1.994 | 2.000 | 1.993 | 2.000 | 2.000 | 1.995 | 2.000 |
| | | | | | | | | | | | | | |
| Sn end | 96.569 | 99.907 | 99.296 | 91.751 | 98.195 | 98.056 | 97.486 | 99.847 | 96.823 | 99.795 | 99.568 | 98.364 | 98.281 |
| FeMn end | 0.783 | 0.040 | 0.123 | 2.298 | 0.530 | 0.583 | 0.443 | 0.055 | 0.589 | 0.076 | 0.161 | 0.218 | 0.581 |
| NbTa end | 2.648 | 0.053 | 0.581 | 5.951 | 1.275 | 1.362 | 2.072 | 0.098 | 2.589 | 0.128 | 0.271 | 1.418 | 1.137 |
| | | | | | | | | | | | | | |
| Nb+Ta | 0.053 | 0.001 | 0.012 | 0.119 | 0.025 | 0.027 | 0.041 | 0.002 | 0.052 | 0.003 | 0.005 | 0.028 | 0.023 |
| Fe+Mn | 0.016 | 0.001 | 0.002 | 0.046 | 0.011 | 0.012 | 0.009 | 0.001 | 0.012 | 0.002 | 0.003 | 0.004 | 0.012 |
| | | | | | | | | | | | | | |
| Comments: | LA & LB | | | LD & LE | | | LI - LK same grain | | | | | | |
| | same grain | | | same grain | | | brown | | mid-brown | | core | inter | rim |
| | core | rim | | | rim | | | colourless | | | | | |

| | Big Whopper pegmatite | | | | | | | Big Whopper pegmatite | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-29G | | | | | | | 96-31 | | | | | | | |
| | EP | EQ | ER | ES | CL | CM | CN | FA | FB | FC | FD | FE | FF | FG | FH |
| SnO2 | 100.43 | 98.23 | 99.02 | 98.05 | 99.65 | 99.89 | 99.09 | 99.62 | 96.71 | 98.59 | 99.90 | 100.06 | 99.68 | 99.81 | 99.51 |
| FeO | 0.03 | 0.20 | 0.25 | 0.29 | 0.10 | 0.11 | 0.22 | 0.00 | 0.17 | 0.11 | 0.00 | 0.05 | 0.05 | 0.07 | 0.05 |
| MnO | 0.00 | 0.10 | 0.01 | 0.02 | 0.03 | 0.00 | 0.00 | 0.05 | 0.29 | 0.02 | 0.00 | 0.00 | 0.00 | 0.04 | 0.00 |
| Nb2O5 | 0.04 | 0.62 | 0.11 | 0.17 | 0.18 | 0.00 | 0.32 | 0.09 | 0.98 | 0.06 | 0.20 | 0.04 | 0.20 | 0.00 | 0.12 |
| Ta2O5 | 0.17 | 1.28 | 1.00 | 1.42 | 0.70 | 0.44 | 0.66 | 0.18 | 2.09 | 0.83 | 0.16 | 0.48 | 0.39 | 0.07 | 0.28 |
| Total | 100.67 | 100.43 | 100.39 | 99.94 | 100.66 | 100.44 | 100.29 | 99.94 | 100.24 | 99.61 | 100.26 | 100.62 | 100.32 | 99.99 | 99.96 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.995 | 1.954 | 1.974 | 1.965 | 1.980 | 1.990 | 1.975 | 1.993 | 1.927 | 1.981 | 1.992 | 1.990 | 1.987 | 1.997 | 1.991 |
| Fe | 0.001 | 0.008 | 0.011 | 0.012 | 0.004 | 0.005 | 0.009 | 0.000 | 0.007 | 0.004 | 0.000 | 0.002 | 0.002 | 0.003 | 0.002 |
| Mn | 0.000 | 0.004 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.002 | 0.012 | 0.001 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 |
| Nb | 0.001 | 0.014 | 0.002 | 0.004 | 0.004 | 0.000 | 0.007 | 0.002 | 0.022 | 0.001 | 0.005 | 0.001 | 0.005 | 0.000 | 0.003 |
| Ta | 0.002 | 0.017 | 0.014 | 0.019 | 0.010 | 0.006 | 0.009 | 0.002 | 0.028 | 0.011 | 0.002 | 0.006 | 0.005 | 0.001 | 0.004 |
| Total | 2.000 | 1.999 | 2.001 | 2.001 | 1.999 | 2.001 | 2.001 | 2.000 | 1.997 | 1.999 | 1.998 | 1.999 | 1.998 | 2.002 | 1.999 |
| Sn end | 99.782 | 97.796 | 98.654 | 98.196 | 99.053 | 99.475 | 98.723 | 99.675 | 96.497 | 99.091 | 99.660 | 99.537 | 99.413 | 99.721 | 99.564 |
| FeMn end | 0.052 | 0.635 | 0.544 | 0.645 | 0.270 | 0.228 | 0.466 | 0.102 | 0.971 | 0.266 | 0.006 | 0.100 | 0.094 | 0.234 | 0.109 |
| NbTa end | 0.166 | 1.569 | 0.802 | 1.159 | 0.677 | 0.297 | 0.811 | 0.223 | 2.533 | 0.643 | 0.334 | 0.363 | 0.493 | 0.045 | 0.327 |
| Nb+Ta | 0.003 | 0.031 | 0.016 | 0.023 | 0.014 | 0.006 | 0.016 | 0.004 | 0.051 | 0.013 | 0.007 | 0.007 | 0.010 | 0.001 | 0.007 |
| Fe+Mn | 0.001 | 0.013 | 0.011 | 0.013 | 0.005 | 0.005 | 0.009 | 0.002 | 0.019 | 0.005 | 0.000 | 0.002 | 0.002 | 0.005 | 0.002 |
| Comments: | EP & EQ same grain | | ER & ES same grain associated with nigerite | | CL - CN same grain<br>core | inter | rim | from a cluster of grains | | | | | | | |

**Big Whopper pegmatite**

**96-31**

| | FI | FJ | FK | FO | FP | FQ | BA | BB | BC | BH | BF | BG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.83 | 99.82 | 98.70 | 99.45 | 99.03 | 94.46 | 99.92 | 99.03 | 97.47 | 99.73 | 97.06 | 99.95 |
| FeO | 0.00 | 0.10 | 0.12 | 0.06 | 0.12 | 0.41 | 0.01 | 0.10 | 0.31 | 0.01 | 0.14 | 0.00 |
| MnO | 0.05 | 0.09 | 0.12 | 0.14 | 0.02 | 0.41 | 0.01 | 0.00 | 0.00 | 0.00 | 0.16 | 0.01 |
| Nb2O5 | 0.31 | 0.00 | 0.43 | 0.00 | 0.27 | 0.90 | 0.00 | 0.06 | 0.15 | 0.02 | 0.33 | 0.03 |
| Ta2O5 | 0.43 | 0.41 | 1.04 | 0.15 | 0.32 | 4.00 | 0.01 | 0.66 | 1.60 | 0.12 | 2.20 | 0.09 |
| Total | 100.62 | 100.43 | 100.41 | 99.81 | 99.76 | 100.17 | 99.95 | 99.85 | 99.53 | 99.88 | 99.88 | 100.09 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.983 | 1.989 | 1.965 | 1.993 | 1.984 | 1.889 | 2.000 | 1.985 | 1.962 | 1.997 | 1.947 | 1.997 |
| Fe | 0.000 | 0.004 | 0.005 | 0.003 | 0.005 | 0.017 | 0.000 | 0.004 | 0.013 | 0.000 | 0.006 | 0.000 |
| Mn | 0.002 | 0.004 | 0.005 | 0.006 | 0.001 | 0.017 | 0.000 | 0.000 | 0.000 | 0.000 | 0.007 | 0.001 |
| Nb | 0.007 | 0.000 | 0.010 | 0.000 | 0.006 | 0.020 | 0.000 | 0.001 | 0.003 | 0.000 | 0.008 | 0.001 |
| Ta | 0.006 | 0.006 | 0.014 | 0.002 | 0.004 | 0.055 | 0.000 | 0.009 | 0.022 | 0.002 | 0.030 | 0.001 |
| Total | 1.998 | 2.003 | 1.999 | 2.004 | 2.000 | 1.998 | 2.000 | 2.000 | 2.000 | 2.000 | 1.997 | 2.000 |
| Sn end | 99.257 | 99.313 | 98.307 | 99.460 | 99.188 | 94.525 | 99.963 | 99.266 | 98.069 | 99.876 | 97.494 | 99.879 |
| FeMn end | 0.099 | 0.407 | 0.509 | 0.436 | 0.282 | 1.722 | 0.034 | 0.212 | 0.665 | 0.021 | 0.624 | 0.028 |
| NbTa end | 0.644 | 0.280 | 1.184 | 0.104 | 0.530 | 3.753 | 0.003 | 0.522 | 1.266 | 0.103 | 1.883 | 0.094 |
| Nb+Ta | 0.013 | 0.006 | 0.024 | 0.002 | 0.011 | 0.075 | 0.000 | 0.010 | 0.025 | 0.002 | 0.038 | 0.002 |
| Fe+Mn | 0.002 | 0.008 | 0.010 | 0.009 | 0.006 | 0.034 | 0.001 | 0.004 | 0.013 | 0.000 | 0.012 | 0.001 |
| Comments: | FI - FK<br>same grain | | | | | | BA & BB<br>same grain<br>core | rim | BC & BH<br>same grain | | BF & BG<br>same grain | |

| | | | **SW Beryl pegmatite** | | | | | **SW Beryl pegmatite** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 96-53A | | | | | 96053A | | | |
| | **TA** | **TB** | **TC** | **TD** | **TE** | **SB** | **SC** | **SD** | **SF** | **SG** | **SH** |
| SnO2 | 97.72 | 98.85 | 98.31 | 97.37 | 98.02 | 99.15 | 99.49 | 99.65 | 99.13 | 98.39 | 97.16 |
| FeO | 0.42 | 0.15 | 0.30 | 0.33 | 0.32 | 0.08 | 0.10 | 0.09 | 0.33 | 0.28 | 0.46 |
| MnO | 0.00 | 0.01 | 0.01 | 0.01 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.02 |
| Nb2O5 | 0.64 | 0.16 | 0.13 | 0.11 | 0.17 | 0.07 | 0.19 | 0.14 | 0.40 | 0.31 | 0.79 |
| Ta2O5 | 1.37 | 0.61 | 1.39 | 1.76 | 1.36 | 0.27 | 0.24 | 0.25 | 0.59 | 1.00 | 1.41 |
| Total | 100.15 | 99.78 | 100.14 | 99.59 | 99.87 | 99.58 | 100.02 | 100.13 | 100.47 | 100.00 | 99.85 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.950 | 1.982 | 1.966 | 1.959 | 1.965 | 1.991 | 1.988 | 1.990 | 1.972 | 1.968 | 1.943 |
| Fe | 0.017 | 0.006 | 0.013 | 0.014 | 0.013 | 0.003 | 0.004 | 0.004 | 0.014 | 0.012 | 0.019 |
| Mn | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 |
| Nb | 0.015 | 0.004 | 0.003 | 0.003 | 0.004 | 0.002 | 0.004 | 0.003 | 0.009 | 0.007 | 0.018 |
| Ta | 0.019 | 0.008 | 0.019 | 0.024 | 0.019 | 0.004 | 0.003 | 0.003 | 0.008 | 0.014 | 0.019 |
| Total | 2.000 | 2.000 | 2.001 | 2.000 | 2.001 | 2.001 | 2.000 | 2.000 | 2.003 | 2.001 | 2.001 |
| Sn end | 97.470 | 99.065 | 98.259 | 97.946 | 98.205 | 99.538 | 99.415 | 99.489 | 98.440 | 98.335 | 97.133 |
| FeMn end | 0.874 | 0.339 | 0.644 | 0.718 | 0.677 | 0.194 | 0.207 | 0.184 | 0.708 | 0.631 | 1.011 |
| NbTa end | 1.655 | 0.596 | 1.097 | 1.336 | 1.118 | 0.268 | 0.378 | 0.327 | 0.851 | 1.034 | 1.856 |
| Nb+Ta | 0.033 | 0.012 | 0.022 | 0.027 | 0.022 | 0.005 | 0.008 | 0.007 | 0.017 | 0.021 | 0.037 |
| Fe+Mn | 0.017 | 0.007 | 0.013 | 0.014 | 0.014 | 0.004 | 0.004 | 0.004 | 0.014 | 0.013 | 0.020 |
| Comments: | | | TA - TE same grain<br>few wodginite inclusions | | | SB & SC<br>same grain | | | SD & SF<br>same grain | | |
| | | | | | | contains a ferrotapiolite/ferrotantalite inclusion | | | | | |

| | JO | JP | JQ | JR | JS | JT | JU | JV | JW | JX | JY |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | **SW Beryl pegmatite** | | | | | | | | **SW Beryl peg.** | | |
| | **96-53B** | | | | | | | | **96-53B** | | |
| **SnO2** | **97.37** | **99.67** | **97.13** | **99.61** | **99.15** | **99.38** | **99.09** | **98.61** | **93.78** | **98.36** | **94.80** |
| **FeO** | **0.36** | **0.13** | **0.49** | **0.17** | **0.24** | **0.00** | **0.17** | **0.21** | **0.92** | **0.35** | **0.75** |
| **MnO** | **0.03** | **0.00** | **0.00** | **0.04** | **0.00** | **0.01** | **0.07** | **0.00** | **0.04** | **0.00** | **0.12** |
| **Nb2O5** | **0.37** | **0.00** | **0.32** | **0.40** | **0.36** | **0.21** | **0.19** | **0.10** | **0.54** | **0.43** | **0.72** |
| **Ta2O5** | **1.51** | **0.55** | **2.11** | **0.31** | **0.62** | **0.51** | **0.52** | **1.45** | **4.35** | **1.14** | **3.53** |
| **Total** | **99.64** | **100.35** | **100.04** | **100.53** | **100.37** | **100.11** | **100.04** | **100.37** | **99.61** | **100.28** | **99.92** |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| **Sn** | **1.955** | **1.988** | **1.945** | **1.979** | **1.974** | **1.985** | **1.981** | **1.968** | **1.890** | **1.961** | **1.901** |
| **Fe** | **0.015** | **0.005** | **0.021** | **0.007** | **0.010** | **0.000** | **0.007** | **0.009** | **0.039** | **0.015** | **0.032** |
| **Mn** | **0.001** | **0.000** | **0.000** | **0.002** | **0.000** | **0.000** | **0.003** | **0.000** | **0.002** | **0.000** | **0.005** |
| **Nb** | **0.008** | **0.000** | **0.007** | **0.009** | **0.008** | **0.005** | **0.004** | **0.002** | **0.012** | **0.010** | **0.016** |
| **Ta** | **0.021** | **0.008** | **0.029** | **0.004** | **0.008** | **0.007** | **0.007** | **0.020** | **0.060** | **0.016** | **0.048** |
| **Total** | **2.001** | **2.001** | **2.001** | **2.001** | **2.001** | **1.997** | **2.002** | **1.999** | **2.002** | **2.001** | **2.002** |
| **Sn end** | **97.721** | **99.350** | **97.170** | **98.900** | **98.669** | **99.399** | **98.922** | **98.463** | **94.396** | **98.006** | **94.933** |
| **FeMn end** | **0.822** | **0.274** | **1.030** | **0.440** | **0.501** | **0.021** | **0.506** | **0.431** | **2.011** | **0.736** | **1.841** |
| **NbTa end** | **1.458** | **0.376** | **1.800** | **0.660** | **0.830** | **0.580** | **0.572** | **1.106** | **3.593** | **1.259** | **3.226** |
| **Nb+Ta** | **0.029** | **0.008** | **0.036** | **0.013** | **0.017** | **0.012** | **0.011** | **0.022** | **0.072** | **0.025** | **0.065** |
| **Fe+Mn** | **0.016** | **0.005** | **0.021** | **0.009** | **0.010** | **0.000** | **0.010** | **0.009** | **0.040** | **0.015** | **0.037** |
| **Comments:** | **JO - JQ traverse** | | | **JR - JT** | | | **JU & JV** | | **JW - JY** | | |
| | **from core to rim** | | | **same grain** | | | **same grain** | | **same grain** | | |
| | **core** | | **rim** | | | | | | | | |

| | Pegmatite 14 | | | | | Pegmatite 14 | | | | | Pegmatite 14 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-57A | | | | | 96-57B | | | | | 96-57C | | | | | |
| | MA | MB | MC | MD | ME | LA | LB | LC | LD | LE | KA | KB | KC | KD | KE | KF |
| SnO2 | 99.56 | 99.87 | 97.87 | 97.38 | 99.86 | 98.49 | 99.25 | 99.24 | 99.57 | 99.20 | 97.58 | 98.22 | 99.33 | 100.00 | 99.31 | 99.20 |
| FeO | 0.04 | 0.00 | 0.23 | 0.20 | 0.08 | 0.15 | 0.11 | 0.00 | 0.16 | 0.04 | 0.08 | 0.00 | 0.00 | 0.00 | 0.10 | 0.15 |
| MnO | 0.00 | 0.10 | 0.14 | 0.15 | 0.00 | 0.01 | 0.02 | 0.05 | 0.00 | 0.00 | 0.23 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 |
| Nb2O5 | 0.19 | 0.23 | 0.87 | 0.95 | 0.00 | 0.12 | 0.04 | 0.00 | 0.04 | 0.12 | 0.38 | 0.30 | 0.29 | 0.00 | 0.35 | 0.00 |
| Ta2O5 | 0.30 | 0.21 | 0.92 | 0.91 | 0.00 | 1.50 | 0.47 | 0.29 | 0.26 | 0.56 | 1.67 | 1.36 | 0.78 | 0.40 | 0.24 | 0.97 |
| Total | 100.10 | 100.41 | 100.03 | 99.59 | 99.94 | 100.27 | 99.89 | 99.57 | 100.02 | 99.92 | 99.93 | 99.99 | 100.40 | 100.40 | 99.99 | 100.33 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.989 | 1.988 | 1.952 | 1.950 | 1.998 | 1.968 | 1.988 | 1.994 | 1.991 | 1.986 | 1.954 | 1.966 | 1.979 | 1.993 | 1.984 | 1.980 |
| Fe | 0.002 | 0.000 | 0.010 | 0.008 | 0.003 | 0.006 | 0.004 | 0.000 | 0.007 | 0.002 | 0.003 | 0.000 | 0.000 | 0.000 | 0.004 | 0.006 |
| Mn | 0.000 | 0.004 | 0.006 | 0.007 | 0.000 | 0.001 | 0.001 | 0.002 | 0.000 | 0.000 | 0.010 | 0.004 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 0.004 | 0.005 | 0.020 | 0.022 | 0.000 | 0.003 | 0.001 | 0.000 | 0.001 | 0.003 | 0.009 | 0.007 | 0.007 | 0.000 | 0.008 | 0.000 |
| Ta | 0.004 | 0.003 | 0.013 | 0.012 | 0.000 | 0.020 | 0.006 | 0.004 | 0.004 | 0.008 | 0.023 | 0.019 | 0.011 | 0.005 | 0.003 | 0.013 |
| Total | 1.999 | 2.000 | 2.000 | 1.999 | 2.002 | 1.998 | 2.001 | 2.000 | 2.002 | 1.998 | 1.999 | 1.996 | 1.996 | 1.999 | 1.999 | 2.000 |
| Sn end | 99.488 | 99.377 | 97.616 | 97.554 | 99.839 | 98.497 | 99.364 | 99.702 | 99.452 | 99.397 | 97.783 | 98.509 | 99.142 | 99.729 | 99.231 | 99.019 |
| FeMn end | 0.088 | 0.222 | 0.769 | 0.748 | 0.161 | 0.340 | 0.267 | 0.100 | 0.329 | 0.080 | 0.645 | 0.215 | 0.000 | 0.000 | 0.212 | 0.322 |
| NbTa end | 0.424 | 0.402 | 1.615 | 1.698 | 0.000 | 1.163 | 0.368 | 0.197 | 0.219 | 0.523 | 1.572 | 1.275 | 0.858 | 0.271 | 0.558 | 0.659 |
| Nb+Ta | 0.008 | 0.008 | 0.032 | 0.034 | 0.000 | 0.023 | 0.007 | 0.004 | 0.004 | 0.010 | 0.031 | 0.025 | 0.017 | 0.005 | 0.011 | 0.013 |
| Fe+Mn | 0.002 | 0.004 | 0.015 | 0.015 | 0.003 | 0.007 | 0.005 | 0.002 | 0.007 | 0.002 | 0.013 | 0.004 | 0.000 | 0.000 | 0.004 | 0.006 |
| Comments: | | MA - MC<br>same grain | | MD & ME<br>same grain | | | LA - LC traverse<br>from core to rim | | LD & LE<br>same grain | | | KA - KC<br>euhedral crystal | | KD & KE<br>same grain | | |
| | | | | | | core | | rim | | | core | | rim | | | |

**Separation Rapids pluton**

96-72B

| | KA | KB | KC | KD | KE | KF | KG | KH | KI | KL | KM |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 95.82 | 98.22 | 95.71 | 97.01 | 98.66 | 98.46 | 97.68 | 96.28 | 98.53 | 97.04 | 98.65 |
| FeO | 0.73 | 0.23 | 0.75 | 0.62 | 0.19 | 0.22 | 0.54 | 0.67 | 0.18 | 0.73 | 0.18 |
| MnO | 0.04 | 0.01 | 0.05 | 0.01 | 0.00 | 0.01 | 0.00 | 0.03 | 0.00 | 0.02 | 0.01 |
| Nb2O5 | 1.29 | 0.21 | 1.33 | 0.81 | 0.09 | 0.47 | 0.66 | 1.19 | 0.16 | 0.82 | 0.09 |
| Ta2O5 | 1.97 | 0.94 | 2.26 | 0.65 | 0.82 | 0.27 | 0.50 | 1.21 | 0.81 | 0.53 | 0.73 |
| | | | | | | | | | | | |
| Total | 99.84 | 99.60 | 100.10 | 99.09 | 99.76 | 99.44 | 99.38 | 99.38 | 99.67 | 99.15 | 99.67 |
| | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.914 | 1.973 | 1.907 | 1.953 | 1.980 | 1.977 | 1.961 | 1.931 | 1.978 | 1.952 | 1.981 |
| Fe | 0.031 | 0.010 | 0.031 | 0.026 | 0.008 | 0.009 | 0.023 | 0.028 | 0.008 | 0.031 | 0.008 |
| Mn | 0.001 | 0.000 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Nb | 0.029 | 0.005 | 0.030 | 0.018 | 0.002 | 0.011 | 0.015 | 0.027 | 0.004 | 0.019 | 0.002 |
| Ta | 0.027 | 0.013 | 0.031 | 0.009 | 0.011 | 0.004 | 0.007 | 0.016 | 0.011 | 0.007 | 0.010 |
| | | | | | | | | | | | |
| Total | 2.002 | 2.001 | 2.002 | 2.006 | 2.001 | 2.001 | 2.006 | 2.004 | 2.000 | 2.009 | 2.001 |
| | | | | | | | | | | | |
| Sn end | 95.596 | 98.619 | 95.292 | 97.315 | 98.947 | 98.791 | 97.777 | 96.351 | 98.891 | 97.131 | 99.002 |
| FeMn end | 1.608 | 0.501 | 1.672 | 1.324 | 0.389 | 0.486 | 1.134 | 1.476 | 0.379 | 1.575 | 0.392 |
| NbTa end | 2.796 | 0.880 | 3.036 | 1.362 | 0.664 | 0.722 | 1.089 | 2.173 | 0.730 | 1.294 | 0.606 |
| | | | | | | | | | | | |
| Nb+Ta | 0.056 | 0.018 | 0.061 | 0.027 | 0.013 | 0.014 | 0.022 | 0.044 | 0.015 | 0.026 | 0.012 |
| Fe+Mn | 0.032 | 0.010 | 0.033 | 0.027 | 0.008 | 0.010 | 0.023 | 0.030 | 0.008 | 0.032 | 0.008 |
| | | | | | | | | | | | |
| Comments: | | KA - KC | | | KD - KF same grain | | KG & KH same grain | | | KL & KM | |
| | | same grain | | brown | | mid-brown | | | | same grain | |
| | | contains tiny inclusions | | | colourless | | | | | | |

| | | | | | SW Beryl pegmatite | | | | | SW Beryl peg. | | SW Beryl peg. | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 96-76 | | | | | 96-76A | | 96-81 | |
| | MB | MC | MD | ME | MI | MJ | MJ | MQ | MR | TA | TK | FB | FC |
| SnO2 | 95.11 | 99.67 | 98.48 | 99.71 | 98.45 | 97.16 | 99.08 | 99.65 | 97.89 | 87.55 | 99.32 | 100.41 | 99.47 |
| FeO | 0.18 | 0.03 | 0.09 | 0.02 | 0.08 | 0.09 | 0.06 | 0.09 | 0.04 | 1.31 | 0.08 | 0.08 | 0.00 |
| MnO | 0.29 | 0.00 | 0.11 | 0.00 | 0.09 | 0.22 | 0.01 | 0.01 | 0.12 | 0.66 | 0.00 | 0.00 | 0.00 |
| Nb2O5 | 1.27 | 0.07 | 0.09 | 0.00 | 0.52 | 0.43 | 0.04 | 0.07 | 0.35 | 1.55 | 0.05 | 0.00 | 0.22 |
| Ta2O5 | 2.61 | 0.25 | 1.43 | 0.28 | 0.60 | 2.02 | 0.70 | 0.30 | 1.23 | 9.37 | 0.51 | 0.30 | 0.36 |
| Total | 99.45 | 100.02 | 100.20 | 100.01 | 99.74 | 99.91 | 99.90 | 100.12 | 99.63 | 100.44 | 99.96 | 100.78 | 100.04 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.909 | 1.993 | 1.969 | 1.995 | 1.971 | 1.947 | 1.985 | 1.991 | 1.966 | 1.754 | 1.988 | 1.993 | 1.988 |
| Fe | 0.007 | 0.001 | 0.004 | 0.001 | 0.003 | 0.004 | 0.003 | 0.004 | 0.002 | 0.055 | 0.003 | 0.003 | 0.000 |
| Mn | 0.012 | 0.000 | 0.005 | 0.000 | 0.004 | 0.009 | 0.001 | 0.000 | 0.005 | 0.028 | 0.000 | 0.000 | 0.000 |
| Nb | 0.029 | 0.001 | 0.002 | 0.000 | 0.012 | 0.010 | 0.001 | 0.002 | 0.008 | 0.035 | 0.001 | 0.000 | 0.005 |
| Ta | 0.036 | 0.003 | 0.020 | 0.004 | 0.008 | 0.028 | 0.010 | 0.004 | 0.017 | 0.128 | 0.007 | 0.004 | 0.005 |
| Total | 1.994 | 1.999 | 1.999 | 1.999 | 1.998 | 1.997 | 1.999 | 2.001 | 1.997 | 2.001 | 2.000 | 2.001 | 1.998 |
| Sn end | 95.772 | 99.694 | 98.515 | 99.768 | 98.651 | 97.483 | 99.321 | 99.509 | 98.420 | 87.682 | 99.423 | 99.640 | 99.511 |
| FeMn end | 0.986 | 0.063 | 0.406 | 0.042 | 0.345 | 0.648 | 0.156 | 0.205 | 0.341 | 4.152 | 0.172 | 0.156 | 0.000 |
| NbTa end | 3.243 | 0.243 | 1.080 | 0.190 | 1.005 | 1.869 | 0.523 | 0.286 | 1.240 | 8.167 | 0.405 | 0.204 | 0.489 |
| Nb+Ta | 0.065 | 0.005 | 0.022 | 0.004 | 0.020 | 0.037 | 0.010 | 0.006 | 0.025 | 0.163 | 0.008 | 0.004 | 0.010 |
| Fe+Mn | 0.020 | 0.001 | 0.008 | 0.001 | 0.007 | 0.013 | 0.003 | 0.004 | 0.007 | 0.083 | 0.003 | 0.003 | 0.000 |
| Comments: | | MC - ME same grain full of wodginite incls. | | | in contact with and earlier than columbite | | | | | note high Ta content | | core | rim |

**SW Beryl pegmatite**

96-85

| | GA | GB | GE | GF | GG | GI | GJ | GL | GM | GN | GO |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.65 | 99.23 | 98.56 | 96.81 | 96.89 | 99.83 | 98.03 | 99.12 | 99.46 | 97.31 | 99.38 |
| FeO | 0.04 | 0.12 | 0.30 | 0.63 | 0.65 | 0.25 | 0.42 | 0.20 | 0.21 | 0.92 | 0.19 |
| MnO | 0.02 | 0.10 | 0.10 | 0.03 | 0.00 | 0.03 | 0.07 | 0.07 | 0.00 | 0.07 | 0.00 |
| Nb2O5 | 0.26 | 0.00 | 0.00 | 0.43 | 0.53 | 0.00 | 0.15 | 0.28 | 0.13 | 1.00 | 0.33 |
| Ta2O5 | 0.27 | 0.62 | 0.60 | 1.35 | 1.73 | 0.62 | 1.86 | 0.51 | 0.62 | 0.78 | 0.34 |
| Total | 100.24 | 100.06 | 99.56 | 99.25 | 99.79 | 100.74 | 100.54 | 100.18 | 100.42 | 100.08 | 100.24 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.987 | 1.985 | 1.981 | 1.951 | 1.942 | 1.984 | 1.954 | 1.978 | 1.981 | 1.938 | 1.981 |
| Fe | 0.002 | 0.005 | 0.013 | 0.027 | 0.027 | 0.010 | 0.018 | 0.008 | 0.009 | 0.038 | 0.008 |
| Mn | 0.001 | 0.004 | 0.004 | 0.001 | 0.000 | 0.001 | 0.003 | 0.003 | 0.000 | 0.003 | 0.000 |
| Nb | 0.006 | 0.000 | 0.000 | 0.010 | 0.012 | 0.000 | 0.003 | 0.006 | 0.003 | 0.023 | 0.007 |
| Ta | 0.004 | 0.008 | 0.008 | 0.018 | 0.024 | 0.008 | 0.025 | 0.007 | 0.008 | 0.011 | 0.005 |
| Total | 1.999 | 2.002 | 2.006 | 2.007 | 2.005 | 2.004 | 2.003 | 2.002 | 2.002 | 2.012 | 2.001 |
| Sn end | 99.392 | 99.120 | 98.744 | 97.196 | 96.875 | 98.997 | 97.530 | 98.777 | 98.989 | 96.290 | 98.999 |
| FeMn end | 0.128 | 0.459 | 0.843 | 1.393 | 1.353 | 0.581 | 1.037 | 0.558 | 0.447 | 2.056 | 0.397 |
| NbTa end | 0.479 | 0.420 | 0.413 | 1.411 | 1.773 | 0.422 | 1.433 | 0.665 | 0.564 | 1.654 | 0.604 |
| Nb+Ta | 0.010 | 0.008 | 0.008 | 0.028 | 0.036 | 0.008 | 0.029 | 0.013 | 0.011 | 0.033 | 0.012 |
| Fe+Mn | 0.003 | 0.009 | 0.017 | 0.028 | 0.027 | 0.012 | 0.021 | 0.011 | 0.009 | 0.041 | 0.008 |
| Comments: | | | GE - GG same grain<br>contains some inclusions<br>core | inter | rim | | | incl.<br>rich<br>core<br>many inclusions | incl.<br>poor<br>rim | core | rim |

| | SW Beryl pegmatite | | | | | | | | | SW Beryl pegmatite | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-86 | | | | | | | | | 96-86B | | |
| | FA | FB | FC | FD | FE | FF | FG | FJ | FK | JA | JB | JE |
| SnO2 | 93.65 | 96.04 | 93.65 | 99.46 | 98.93 | 98.61 | 97.68 | 96.36 | 98.83 | 98.91 | 99.80 | 100.02 |
| FeO | 0.59 | 0.32 | 0.75 | 0.02 | 0.10 | 0.19 | 0.25 | 0.26 | 0.13 | 0.11 | 0.00 | 0.02 |
| MnO | 0.18 | 0.07 | 0.08 | 0.01 | 0.00 | 0.04 | 0.01 | 0.11 | 0.00 | 0.14 | 0.10 | 0.04 |
| Nb2O5 | 0.47 | 0.20 | 0.69 | 0.01 | 0.19 | 0.17 | 0.05 | 0.82 | 0.08 | 0.00 | 0.22 | 0.00 |
| Ta2O5 | 4.57 | 2.16 | 4.28 | 0.45 | 0.61 | 1.09 | 1.46 | 1.77 | 0.77 | 0.68 | 0.00 | 0.46 |
| Total | 99.46 | 98.77 | 99.44 | 99.95 | 99.84 | 100.10 | 99.45 | 99.32 | 99.81 | 99.83 | 100.12 | 100.55 |
| Structural formulae based on 4 oxygens | | | | | | | | | | | | |
| Sn | 1.892 | 1.949 | 1.889 | 1.991 | 1.982 | 1.972 | 1.968 | 1.938 | 1.982 | 1.983 | 1.992 | 1.991 |
| Fe | 0.025 | 0.013 | 0.032 | 0.001 | 0.004 | 0.008 | 0.011 | 0.011 | 0.006 | 0.005 | 0.000 | 0.001 |
| Mn | 0.008 | 0.003 | 0.003 | 0.000 | 0.000 | 0.002 | 0.000 | 0.005 | 0.000 | 0.006 | 0.004 | 0.002 |
| Nb | 0.011 | 0.005 | 0.016 | 0.000 | 0.004 | 0.004 | 0.001 | 0.019 | 0.002 | 0.000 | 0.005 | 0.000 |
| Ta | 0.063 | 0.030 | 0.059 | 0.006 | 0.008 | 0.015 | 0.020 | 0.024 | 0.010 | 0.009 | 0.000 | 0.006 |
| Total | 1.998 | 2.000 | 1.999 | 1.999 | 1.999 | 2.000 | 2.000 | 1.997 | 2.000 | 2.003 | 2.001 | 2.000 |
| Sn end | 94.672 | 97.463 | 94.524 | 99.618 | 99.140 | 98.581 | 98.385 | 97.065 | 99.102 | 99.020 | 99.541 | 99.550 |
| FeMn end | 1.639 | 0.819 | 1.742 | 0.061 | 0.225 | 0.483 | 0.556 | 0.782 | 0.284 | 0.518 | 0.210 | 0.137 |
| NbTa end | 3.689 | 1.718 | 3.734 | 0.321 | 0.635 | 0.935 | 1.059 | 2.153 | 0.614 | 0.462 | 0.249 | 0.313 |
| Nb+Ta | 0.074 | 0.034 | 0.075 | 0.006 | 0.013 | 0.019 | 0.021 | 0.043 | 0.012 | 0.009 | 0.005 | 0.006 |
| Fe+Mn | 0.033 | 0.016 | 0.035 | 0.001 | 0.004 | 0.010 | 0.011 | 0.016 | 0.006 | 0.010 | 0.004 | 0.003 |
| Comments: | FA & FB<br>same grain | | FC & FD<br>same grain | | | | | brown | | JA & JB<br>same grain<br>inclusion in<br>ferrocolumbite | | |

## Cassiterite

| | Great White North pegmatite | | | | | | Marko's pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-87 | | | | | | 96-AT3 | | | | |
| | SA | SB | SC | SD | SE | SF | AA | AB | AC | AD | AE |
| SnO2 | 97.32 | 98.52 | 99.18 | 98.09 | 96.75 | 99.19 | 97.50 | 96.44 | 97.42 | 94.90 | 98.30 |
| FeO | 0.00 | 0.00 | 0.04 | 0.07 | 0.00 | 0.09 | 0.26 | 0.56 | 0.36 | 0.78 | 0.17 |
| MnO | 0.19 | 0.12 | 0.10 | 0.12 | 0.24 | 0.03 | 0.00 | 0.04 | 0.02 | 0.07 | 0.00 |
| Nb2O5 | 1.13 | 0.94 | 0.94 | 1.18 | 1.45 | 0.03 | 0.11 | 0.61 | 0.37 | 0.75 | 0.08 |
| Ta2O5 | 1.28 | 0.80 | 0.51 | 0.50 | 1.18 | 0.19 | 1.43 | 2.76 | 1.59 | 3.80 | 1.10 |
| Total | 99.92 | 100.38 | 100.77 | 99.95 | 99.62 | 99.52 | 99.31 | 100.41 | 99.76 | 100.30 | 99.65 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.942 | 1.957 | 1.962 | 1.954 | 1.934 | 1.993 | 1.967 | 1.923 | 1.954 | 1.896 | 1.975 |
| Fe | 0.000 | 0.000 | 0.002 | 0.003 | 0.000 | 0.004 | 0.011 | 0.023 | 0.015 | 0.033 | 0.007 |
| Mn | 0.008 | 0.005 | 0.004 | 0.005 | 0.010 | 0.001 | 0.000 | 0.002 | 0.001 | 0.003 | 0.000 |
| Nb | 0.025 | 0.021 | 0.021 | 0.027 | 0.033 | 0.001 | 0.003 | 0.014 | 0.008 | 0.017 | 0.002 |
| Ta | 0.017 | 0.011 | 0.007 | 0.007 | 0.016 | 0.003 | 0.020 | 0.038 | 0.022 | 0.052 | 0.015 |
| Total | 1.993 | 1.995 | 1.996 | 1.996 | 1.993 | 2.002 | 2.000 | 2.000 | 2.000 | 2.001 | 1.999 |
| Sn end | 97.451 | 98.137 | 98.316 | 97.926 | 97.040 | 99.591 | 98.325 | 96.178 | 97.702 | 94.779 | 98.798 |
| FeMn end | 0.396 | 0.260 | 0.281 | 0.407 | 0.507 | 0.247 | 0.565 | 1.254 | 0.787 | 1.782 | 0.352 |
| NbTa end | 2.153 | 1.603 | 1.403 | 1.667 | 2.453 | 0.162 | 1.110 | 2.568 | 1.511 | 3.439 | 0.850 |
| Nb+Ta | 0.043 | 0.032 | 0.028 | 0.033 | 0.049 | 0.003 | 0.022 | 0.051 | 0.030 | 0.069 | 0.017 |
| Fe+Mn | 0.008 | 0.005 | 0.006 | 0.008 | 0.010 | 0.005 | 0.011 | 0.025 | 0.016 | 0.036 | 0.007 |
| Comments: | | SA - SD | | | SE & SF | | AA & AB | | | AC - AE | |
| | | same grain | | | same grain | | same grain | | | same grain | |
| | | | from large zoned cassiterite crystals | | | | | | contains tiny inclusions | | |

## Cassiterite

| | **Marko's pegmatite** | | | | **Marko's pegmatite** | | | | | **Marko's pegmatite** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT4 | | | | 96-AT5 | | | | | 96-AT8 | | | |
| | NA | NB | NC | ND | BA | BB | BC | BD | BE | EA | EB | EC | ED |
| SnO2 | 97.49 | 96.83 | 96.45 | 98.56 | 98.71 | 98.23 | 97.85 | 98.90 | 96.45 | 98.58 | 95.89 | 95.92 | 99.33 |
| FeO | 0.23 | 0.40 | 0.46 | 0.12 | 0.06 | 0.16 | 0.22 | 0.07 | 0.32 | 0.13 | 0.54 | 0.39 | 0.02 |
| MnO | 0.00 | 0.03 | 0.04 | 0.00 | 0.00 | 0.03 | 0.01 | 0.01 | 0.08 | 0.00 | 0.05 | 0.04 | 0.00 |
| Nb2O5 | 0.12 | 0.43 | 0.50 | 0.05 | 0.04 | 0.05 | 0.45 | 0.02 | 0.14 | 0.06 | 0.59 | 0.51 | 0.00 |
| Ta2O5 | 1.30 | 1.43 | 1.66 | 0.77 | 0.46 | 1.16 | 0.98 | 0.51 | 2.50 | 0.70 | 2.50 | 1.82 | 0.31 |
| Total | 99.14 | 99.12 | 99.11 | 99.51 | 99.27 | 99.63 | 99.51 | 99.51 | 99.48 | 99.47 | 99.56 | 98.67 | 99.67 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.969 | 1.954 | 1.947 | 1.983 | 1.990 | 1.975 | 1.966 | 1.989 | 1.945 | 1.984 | 1.928 | 1.945 | 1.994 |
| Fe | 0.010 | 0.017 | 0.019 | 0.005 | 0.003 | 0.007 | 0.009 | 0.003 | 0.013 | 0.006 | 0.023 | 0.017 | 0.001 |
| Mn | 0.000 | 0.001 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.003 | 0.000 | 0.002 | 0.002 | 0.000 |
| Nb | 0.003 | 0.010 | 0.011 | 0.001 | 0.001 | 0.001 | 0.010 | 0.001 | 0.003 | 0.001 | 0.013 | 0.012 | 0.000 |
| Ta | 0.018 | 0.020 | 0.023 | 0.011 | 0.006 | 0.016 | 0.013 | 0.007 | 0.034 | 0.010 | 0.034 | 0.025 | 0.004 |
| Total | 2.000 | 2.002 | 2.002 | 2.000 | 2.000 | 2.000 | 1.999 | 2.000 | 1.999 | 2.000 | 2.001 | 2.000 | 2.000 |
| Sn end | 98.482 | 97.628 | 97.241 | 99.154 | 99.508 | 98.749 | 98.340 | 99.457 | 97.285 | 99.175 | 96.376 | 97.241 | 99.731 |
| FeMn end | 0.485 | 0.895 | 1.048 | 0.264 | 0.135 | 0.395 | 0.479 | 0.167 | 0.838 | 0.283 | 1.245 | 0.922 | 0.057 |
| NbTa end | 1.032 | 1.477 | 1.712 | 0.583 | 0.356 | 0.856 | 1.182 | 0.376 | 1.877 | 0.542 | 2.379 | 1.837 | 0.212 |
| Nb+Ta | 0.021 | 0.030 | 0.034 | 0.012 | 0.007 | 0.017 | 0.024 | 0.008 | 0.038 | 0.011 | 0.048 | 0.037 | 0.004 |
| Fe+Mn | 0.010 | 0.018 | 0.021 | 0.005 | 0.003 | 0.008 | 0.010 | 0.003 | 0.017 | 0.006 | 0.025 | 0.018 | 0.001 |
| Comments: | NA - ND<br>same grain<br>contains many microlite inclusions<br>and exsolved material | | | | BA - BE<br>same grain<br>contains microlite and<br>manganotantalite inclusions | | | | | EA & EB<br>same grain<br>contains microlite,<br>titanowodginite &<br>ferrotitanowodginite inclusions | | EC & ED<br>same grain | |

| | **Marko's pegmatite** | | | | | | **Marko's pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT11A | | | | | | 96-AT11B | | | | | | |
| | QB | QE | QG | QH | QI | QO | OA | OB | OC | OD | OE | OF | OG |
| SnO2 | 96.00 | 99.10 | 94.00 | 92.41 | 93.77 | 98.66 | 100.14 | 98.19 | 98.09 | 98.13 | 98.85 | 99.44 | 99.55 |
| FeO | 0.55 | 0.08 | 0.71 | 1.00 | 0.76 | 0.14 | 0.05 | 0.13 | 0.19 | 0.12 | 0.11 | 0.12 | 0.06 |
| MnO | 0.05 | 0.01 | 0.07 | 0.07 | 0.06 | 0.00 | 0.00 | 0.03 | 0.03 | 0.03 | 0.01 | 0.01 | 0.01 |
| Nb2O5 | 0.75 | 0.06 | 0.92 | 1.01 | 0.91 | 0.06 | 0.12 | 0.03 | 0.06 | 0.04 | 0.58 | 0.54 | 0.19 |
| Ta2O5 | 2.77 | 0.68 | 3.34 | 4.65 | 3.52 | 0.79 | 0.06 | 1.10 | 1.46 | 1.09 | 0.22 | 0.23 | 0.19 |
| Total | 100.12 | 99.93 | 99.04 | 99.14 | 99.02 | 99.66 | 100.20 | 99.48 | 99.83 | 99.41 | 99.78 | 100.34 | 100.00 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.919 | 1.985 | 1.900 | 1.868 | 1.896 | 1.982 | 1.995 | 1.977 | 1.969 | 1.977 | 1.977 | 1.978 | 1.990 |
| Fe | 0.023 | 0.003 | 0.030 | 0.042 | 0.032 | 0.006 | 0.002 | 0.005 | 0.008 | 0.005 | 0.005 | 0.005 | 0.003 |
| Mn | 0.002 | 0.001 | 0.003 | 0.003 | 0.003 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 |
| Nb | 0.017 | 0.001 | 0.021 | 0.023 | 0.021 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.013 | 0.012 | 0.004 |
| Ta | 0.038 | 0.009 | 0.046 | 0.064 | 0.049 | 0.011 | 0.001 | 0.015 | 0.020 | 0.015 | 0.003 | 0.003 | 0.003 |
| Total | 1.999 | 1.999 | 2.000 | 2.001 | 2.000 | 2.000 | 2.000 | 1.999 | 1.999 | 1.999 | 1.999 | 1.999 | 2.000 |
| Sn end | 96.007 | 99.283 | 94.991 | 93.376 | 94.783 | 99.089 | 99.718 | 98.869 | 98.470 | 98.897 | 98.929 | 98.958 | 99.508 |
| FeMn end | 1.253 | 0.187 | 1.655 | 2.265 | 1.746 | 0.299 | 0.104 | 0.341 | 0.462 | 0.303 | 0.261 | 0.276 | 0.145 |
| NbTa end | 2.739 | 0.530 | 3.354 | 4.359 | 3.470 | 0.611 | 0.177 | 0.790 | 1.068 | 0.800 | 0.810 | 0.766 | 0.347 |
| Nb+Ta | 0.055 | 0.011 | 0.067 | 0.087 | 0.069 | 0.012 | 0.004 | 0.016 | 0.021 | 0.016 | 0.016 | 0.015 | 0.007 |
| Fe+Mn | 0.025 | 0.004 | 0.033 | 0.045 | 0.035 | 0.006 | 0.002 | 0.007 | 0.009 | 0.006 | 0.005 | 0.006 | 0.003 |
| Comments: | | | QB - QI<br>same grain<br>contains microlite &<br>ferrotitanowodginite inclusions | | | | | | OB - OD<br>same grain<br>contains microlite<br>inclusion | | | OE - OG<br>same grain | |

| | **Marko's pegmatite** | | | | | **Marko's pegmatite** | | | | | **Marko's peg.** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT12 | | | | | 96-AT13 | | | | | 96-AT15 | |
| | GA | GB | GC | GD | GE | LA | LB | LC | LD | LE | GF | GG |
| SnO2 | 96.64 | 96.86 | 97.44 | 98.75 | 99.58 | 99.37 | 98.71 | 98.42 | 98.71 | 99.43 | 94.74 | 94.41 |
| FeO | 0.41 | 0.38 | 0.33 | 0.20 | 0.02 | 0.04 | 0.13 | 0.23 | 0.13 | 0.05 | 0.57 | 0.56 |
| MnO | 0.03 | 0.04 | 0.02 | 0.00 | 0.00 | 0.00 | 0.01 | 0.03 | 0.01 | 0.01 | 0.09 | 0.15 |
| Nb2O5 | 0.49 | 0.41 | 0.67 | 0.11 | 0.02 | 0.03 | 0.10 | 0.42 | 0.05 | 0.03 | 0.41 | 0.08 |
| Ta2O5 | 1.46 | 1.67 | 1.16 | 1.09 | 0.13 | 0.33 | 0.74 | 0.90 | 0.83 | 0.28 | 4.66 | 4.59 |
| Total | 99.03 | 99.36 | 99.62 | 100.15 | 99.75 | 99.77 | 99.69 | 100.01 | 99.72 | 99.79 | 100.46 | 99.80 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | |
| Sn | 1.952 | 1.951 | 1.954 | 1.974 | 1.997 | 1.993 | 1.982 | 1.967 | 1.982 | 1.993 | 1.895 | 1.904 |
| Fe | 0.017 | 0.016 | 0.014 | 0.008 | 0.001 | 0.002 | 0.005 | 0.010 | 0.005 | 0.002 | 0.024 | 0.024 |
| Mn | 0.001 | 0.002 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.004 | 0.006 |
| Nb | 0.011 | 0.009 | 0.015 | 0.003 | 0.000 | 0.001 | 0.002 | 0.010 | 0.001 | 0.001 | 0.009 | 0.002 |
| Ta | 0.020 | 0.023 | 0.016 | 0.015 | 0.002 | 0.005 | 0.010 | 0.012 | 0.011 | 0.004 | 0.064 | 0.063 |
| Total | 2.002 | 2.001 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 1.995 | 1.999 |
| Sn end | 97.500 | 97.497 | 97.705 | 98.715 | 99.854 | 99.652 | 99.085 | 98.355 | 99.090 | 99.661 | 94.974 | 95.242 |
| FeMn end | 0.936 | 0.888 | 0.741 | 0.415 | 0.038 | 0.084 | 0.293 | 0.554 | 0.287 | 0.114 | 1.373 | 1.506 |
| NbTa end | 1.563 | 1.616 | 1.554 | 0.870 | 0.108 | 0.263 | 0.622 | 1.091 | 0.624 | 0.226 | 3.653 | 3.252 |
| Nb+Ta | 0.031 | 0.032 | 0.031 | 0.017 | 0.002 | 0.005 | 0.012 | 0.022 | 0.012 | 0.005 | 0.073 | 0.065 |
| Fe+Mn | 0.019 | 0.018 | 0.015 | 0.008 | 0.001 | 0.002 | 0.006 | 0.011 | 0.006 | 0.002 | 0.027 | 0.030 |
| Comments: | GA & GB<br>same grain | | | GD & GE<br>same grain | | | | LA - LE<br>same grain<br>contains microlite inclusions | | | GF & GG<br>same grain | |
| | contains microlite, titanowodginite<br>& ferrotitanowodginite inclusions | | | | | | | | | | | |

| | **Marko's pegmatite** | | | | | | **Pegmatite 6** | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 96-AT17 | | | | | | 96-AT21A | | | |
| | RR | RT | RU | RV | RW | RX | KA | KB | KD | KE |
| SnO2 | 92.99 | 95.31 | 97.26 | 93.37 | 93.27 | 93.09 | 97.16 | 97.64 | 98.03 | 97.14 |
| FeO | 0.91 | 0.62 | 0.32 | 0.84 | 0.85 | 0.94 | 0.35 | 0.32 | 0.22 | 0.40 |
| MnO | 0.10 | 0.07 | 0.02 | 0.09 | 0.08 | 0.05 | 0.01 | 0.01 | 0.00 | 0.01 |
| Nb2O5 | 0.88 | 0.65 | 0.51 | 0.78 | 0.76 | 0.89 | 0.24 | 0.24 | 0.19 | 0.50 |
| Ta2O5 | 4.65 | 3.09 | 1.30 | 4.27 | 4.32 | 4.62 | 1.51 | 1.38 | 0.89 | 1.31 |
| | | | | | | | | | | |
| Total | 99.53 | 99.74 | 99.41 | 99.36 | 99.28 | 99.57 | 99.26 | 99.59 | 99.33 | 99.35 |
| | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.874 | 1.914 | 1.956 | 1.884 | 1.884 | 1.875 | 1.960 | 1.963 | 1.975 | 1.955 |
| Fe | 0.039 | 0.026 | 0.014 | 0.036 | 0.036 | 0.040 | 0.015 | 0.013 | 0.009 | 0.017 |
| Mn | 0.004 | 0.003 | 0.001 | 0.004 | 0.003 | 0.002 | 0.000 | 0.000 | 0.000 | 0.000 |
| Nb | 0.020 | 0.015 | 0.012 | 0.018 | 0.017 | 0.020 | 0.006 | 0.005 | 0.004 | 0.011 |
| Ta | 0.064 | 0.042 | 0.018 | 0.059 | 0.060 | 0.063 | 0.021 | 0.019 | 0.012 | 0.018 |
| | | | | | | | | | | |
| Total | 2.000 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 2.001 | 2.001 | 2.000 | 2.001 |
| | | | | | | | | | | |
| Sn end | 93.669 | 95.699 | 97.795 | 94.196 | 94.185 | 93.741 | 97.943 | 98.089 | 98.710 | 97.683 |
| FeMn end | 2.136 | 1.442 | 0.732 | 1.968 | 1.968 | 2.075 | 0.742 | 0.698 | 0.460 | 0.850 |
| NbTa end | 4.194 | 2.858 | 1.472 | 3.836 | 3.848 | 4.183 | 1.315 | 1.214 | 0.829 | 1.466 |
| | | | | | | | | | | |
| Nb+Ta | 0.084 | 0.057 | 0.029 | 0.077 | 0.077 | 0.084 | 0.026 | 0.024 | 0.017 | 0.029 |
| Fe+Mn | 0.043 | 0.029 | 0.015 | 0.039 | 0.039 | 0.042 | 0.015 | 0.014 | 0.009 | 0.017 |
| | | | | | | | | | | |
| Comments: | | RT - RU | | RV - RX | | | KA - KE | | | |
| | | same grain | | same grain | | | same grain | | | |
| | contains euhedral inclusions of zoned | | | | | | | | | |
| | antimonian microlite & ferrotitanowodginite | | | | | | | | | |

| | | | Pegmatite 5 | | | | |
|---|---|---|---|---|---|---|---|
| | | | 96-AT23 | | | | |
| | NA | NC | ND | NE | NL | NM | NS |
| SnO2 | 90.54 | 92.71 | 98.75 | 94.39 | 90.45 | 90.05 | 90.97 |
| FeO | 1.28 | 1.04 | 0.28 | 0.75 | 1.26 | 1.33 | 1.26 |
| MnO | 0.05 | 0.05 | 0.01 | 0.04 | 0.07 | 0.06 | 0.07 |
| Nb2O5 | 0.89 | 0.58 | 0.11 | 0.47 | 0.97 | 0.86 | 0.84 |
| Ta2O5 | 6.47 | 5.52 | 1.62 | 3.77 | 6.52 | 6.90 | 6.85 |
| Total | 99.23 | 99.90 | 100.76 | 99.43 | 99.27 | 99.19 | 99.99 |
| | **Structural formulae based on 4 oxygens** | | | | | | |
| Sn | 1.834 | 1.866 | 1.963 | 1.905 | 1.831 | 1.827 | 1.831 |
| Fe | 0.054 | 0.044 | 0.012 | 0.032 | 0.053 | 0.056 | 0.053 |
| Mn | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.002 | 0.003 |
| Nb | 0.020 | 0.013 | 0.002 | 0.011 | 0.022 | 0.020 | 0.019 |
| Ta | 0.089 | 0.076 | 0.022 | 0.052 | 0.090 | 0.095 | 0.094 |
| Total | 2.001 | 2.001 | 2.000 | 2.001 | 2.000 | 2.001 | 2.000 |
| Sn end | 91.685 | 93.250 | 98.168 | 95.195 | 91.567 | 91.302 | 91.532 |
| FeMn end | 2.826 | 2.298 | 0.613 | 1.672 | 2.815 | 2.942 | 2.815 |
| NbTa end | 5.489 | 4.451 | 1.219 | 3.133 | 5.618 | 5.755 | 5.653 |
| Nb+Ta | 0.110 | 0.089 | 0.024 | 0.063 | 0.112 | 0.115 | 0.113 |
| Fe+Mn | 0.057 | 0.046 | 0.012 | 0.033 | 0.056 | 0.059 | 0.056 |
| Comments: | | | NA - NE<br>same grain<br>contains large inclusions of<br>tungsteniferous ferrowodginite | | | NL - NS<br>same grain | |

**Near School of Fish**

97-1

| | CE | CF | CG | QA | QB | QC | QI | QJ | QL | QM |
|---|---|---|---|---|---|---|---|---|---|---|
| $SnO_2$ | 97.94 | 97.28 | 99.09 | 99.14 | 99.68 | 98.95 | 99.10 | 99.44 | 97.67 | 99.39 |
| FeO | 0.32 | 0.30 | 0.07 | 0.23 | 0.09 | 0.29 | 0.15 | 0.10 | 0.41 | 0.20 |
| MnO | 0.02 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.03 | 0.00 | 0.05 | 0.06 |
| $Nb_2O_5$ | 0.45 | 0.48 | 0.05 | 0.30 | 0.05 | 0.40 | 0.28 | 0.04 | 0.46 | 0.21 |
| $Ta_2O_5$ | 0.75 | 1.30 | 0.38 | 0.73 | 0.21 | 0.68 | 0.67 | 0.34 | 1.57 | 0.60 |
| | | | | | | | | | | |
| Total | 99.48 | 99.36 | 99.59 | 100.41 | 100.04 | 100.33 | 100.22 | 99.92 | 100.16 | 100.46 |
| | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.967 | 1.958 | 1.991 | 1.974 | 1.993 | 1.971 | 1.977 | 1.991 | 1.951 | 1.979 |
| Fe | 0.013 | 0.013 | 0.003 | 0.010 | 0.004 | 0.012 | 0.006 | 0.004 | 0.017 | 0.008 |
| Mn | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.002 |
| Nb | 0.010 | 0.011 | 0.001 | 0.007 | 0.001 | 0.009 | 0.006 | 0.001 | 0.010 | 0.005 |
| Ta | 0.010 | 0.018 | 0.005 | 0.010 | 0.003 | 0.009 | 0.009 | 0.005 | 0.021 | 0.008 |
| | | | | | | | | | | |
| Total | 2.002 | 1.999 | 2.000 | 2.001 | 2.001 | 2.002 | 2.000 | 2.001 | 2.002 | 2.002 |
| | | | | | | | | | | |
| Sn end | 98.265 | 97.924 | 99.535 | 98.675 | 99.603 | 98.462 | 98.870 | 99.507 | 97.449 | 98.822 |
| FeMn end | 0.710 | 0.638 | 0.150 | 0.495 | 0.195 | 0.629 | 0.358 | 0.218 | 0.966 | 0.535 |
| NbTa end | 1.025 | 1.439 | 0.315 | 0.830 | 0.202 | 0.910 | 0.771 | 0.275 | 1.585 | 0.643 |
| | | | | | | | | | | |
| Nb+Ta | 0.021 | 0.029 | 0.006 | 0.017 | 0.004 | 0.018 | 0.015 | 0.005 | 0.032 | 0.013 |
| Fe+Mn | 0.014 | 0.013 | 0.003 | 0.010 | 0.004 | 0.013 | 0.007 | 0.004 | 0.019 | 0.011 |
| | | | | | | | | | | |
| Comments: | CE - CG same grain | | | | QA - QC | | QI & QJ | | inclusions | |
| | | | rim | | same grain | | same grain | | in garnet | |

| | SW Beryl pegmatite | | | | | | | | SW Be peg. | | SW Beryl aplite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-16A | | | | | | | | 97-16B | | 97-69 | | | | |
| | NE | NF | NG | NH | NI | NJ | NK | NL | EG | EH | CG | CH | CI | CJ | CK |
| SnO2 | 98.98 | 98.02 | 98.89 | 99.87 | 98.86 | 97.43 | 96.78 | 99.27 | 99.45 | 98.85 | 95.23 | 96.32 | 96.07 | 97.53 | 98.93 |
| FeO | 0.09 | 0.15 | 0.19 | 0.00 | 0.09 | 0.18 | 0.44 | 0.06 | 0.01 | 0.11 | 0.46 | 0.42 | 0.49 | 0.29 | 0.07 |
| MnO | 0.03 | 0.08 | 0.01 | 0.00 | 0.04 | 0.10 | 0.08 | 0.02 | 0.00 | 0.01 | 0.08 | 0.01 | 0.01 | 0.02 | 0.00 |
| Nb2O5 | 0.08 | 0.25 | 0.20 | 0.03 | 0.16 | 0.28 | 1.32 | 0.07 | 0.00 | 0.09 | 0.18 | 0.08 | 0.16 | 0.52 | 0.01 |
| Ta2O5 | 0.83 | 1.58 | 0.79 | 0.19 | 0.83 | 1.90 | 1.12 | 0.72 | 0.25 | 0.66 | 3.17 | 2.36 | 2.74 | 1.64 | 0.61 |
| Total | 100.01 | 100.08 | 100.07 | 100.09 | 99.97 | 99.89 | 99.74 | 100.13 | 99.71 | 99.72 | 99.12 | 99.18 | 99.47 | 99.99 | 99.62 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Sn | 1.981 | 1.961 | 1.977 | 1.996 | 1.979 | 1.954 | 1.933 | 1.984 | 1.996 | 1.984 | 1.929 | 1.948 | 1.938 | 1.951 | 1.988 |
| Fe | 0.004 | 0.006 | 0.008 | 0.000 | 0.004 | 0.007 | 0.018 | 0.003 | 0.000 | 0.005 | 0.019 | 0.018 | 0.021 | 0.012 | 0.003 |
| Mn | 0.001 | 0.004 | 0.000 | 0.000 | 0.002 | 0.004 | 0.003 | 0.001 | 0.000 | 0.000 | 0.004 | 0.001 | 0.000 | 0.001 | 0.000 |
| Nb | 0.002 | 0.006 | 0.005 | 0.001 | 0.004 | 0.006 | 0.030 | 0.001 | 0.000 | 0.002 | 0.004 | 0.002 | 0.004 | 0.012 | 0.000 |
| Ta | 0.011 | 0.022 | 0.011 | 0.003 | 0.011 | 0.026 | 0.015 | 0.010 | 0.003 | 0.009 | 0.044 | 0.032 | 0.038 | 0.022 | 0.008 |
| Total | 1.999 | 1.998 | 2.000 | 1.999 | 1.999 | 1.998 | 1.999 | 1.999 | 1.999 | 2.000 | 2.000 | 2.001 | 2.000 | 1.998 | 1.999 |
| Sn end | 99.083 | 98.136 | 98.827 | 99.830 | 98.984 | 97.795 | 96.658 | 99.270 | 99.811 | 99.197 | 96.453 | 97.377 | 96.886 | 97.644 | 99.429 |
| FeMn end | 0.265 | 0.500 | 0.409 | 0.008 | 0.270 | 0.582 | 1.079 | 0.164 | 0.017 | 0.255 | 1.149 | 0.910 | 1.041 | 0.645 | 0.146 |
| NbTa end | 0.652 | 1.364 | 0.765 | 0.161 | 0.746 | 1.623 | 2.263 | 0.566 | 0.172 | 0.549 | 2.398 | 1.713 | 2.073 | 1.711 | 0.425 |
| Nb+Ta | 0.013 | 0.027 | 0.015 | 0.003 | 0.015 | 0.032 | 0.045 | 0.011 | 0.003 | 0.011 | 0.048 | 0.034 | 0.041 | 0.034 | 0.009 |
| Fe+Mn | 0.005 | 0.010 | 0.008 | 0.000 | 0.005 | 0.012 | 0.022 | 0.003 | 0.000 | 0.005 | 0.023 | 0.018 | 0.021 | 0.013 | 0.003 |
| Comments: | NE & NF<br>same grain | | NG & NH<br>same grain | | NI & NJ<br>same grain | | NK & NL<br>same grain | | EG & EH<br>same grain | | | CG - CI<br>same grain | | CJ & CK<br>same grain | |
| | | | | | | | core | rim | | rim | contains inclusions of ferrotapiolite | & ferrowodginite | | | |
| | | | all aligned along single veinlet<br>running through the thin section | | | | | | | | | | | | |

| | **School of Fish** | | | | | | **SW Beryl pegmatite** | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-70 | | | | | | 97-134A | | | | | |
| | EK | EL | DF | DG | DH | DI | DJ | DK | DL | DM | DN | DQ |
| SnO2 | 99.29 | 99.00 | 99.27 | 97.53 | 98.67 | 92.23 | 94.07 | 99.44 | 91.91 | 99.13 | 99.59 | 99.04 |
| FeO | 0.06 | 0.08 | 0.09 | 0.08 | 0.01 | 0.06 | 0.03 | 0.01 | 0.22 | 0.11 | 0.10 | 0.12 |
| MnO | 0.00 | 0.00 | 0.00 | 0.16 | 0.06 | 0.81 | 0.61 | 0.00 | 0.67 | 0.00 | 0.00 | 0.01 |
| Nb2O5 | 0.08 | 0.14 | 0.11 | 0.19 | 0.04 | 0.89 | 0.73 | 0.00 | 0.65 | 0.14 | 0.07 | 0.15 |
| Ta2O5 | 0.10 | 0.18 | 0.21 | 1.94 | 0.89 | 5.31 | 3.97 | 0.15 | 5.37 | 0.28 | 0.14 | 0.19 |
| Total | 99.53 | 99.40 | 99.68 | 99.89 | 99.67 | 99.30 | 99.40 | 99.60 | 98.82 | 99.66 | 99.89 | 99.51 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.995 | 1.991 | 1.991 | 1.956 | 1.982 | 1.864 | 1.897 | 1.997 | 1.869 | 1.989 | 1.994 | 1.990 |
| Fe | 0.003 | 0.004 | 0.004 | 0.003 | 0.000 | 0.002 | 0.001 | 0.000 | 0.009 | 0.005 | 0.004 | 0.005 |
| Mn | 0.000 | 0.000 | 0.000 | 0.007 | 0.003 | 0.035 | 0.026 | 0.000 | 0.029 | 0.000 | 0.000 | 0.000 |
| Nb | 0.002 | 0.003 | 0.002 | 0.004 | 0.001 | 0.020 | 0.017 | 0.000 | 0.015 | 0.003 | 0.002 | 0.003 |
| Ta | 0.001 | 0.002 | 0.003 | 0.027 | 0.012 | 0.073 | 0.055 | 0.002 | 0.074 | 0.004 | 0.002 | 0.003 |
| Total | 2.001 | 2.000 | 2.001 | 1.997 | 1.998 | 1.995 | 1.996 | 2.000 | 1.997 | 2.001 | 2.001 | 2.001 |
| Sn end | 99.703 | 99.541 | 99.536 | 97.951 | 99.200 | 93.448 | 95.0[illegible] | 99.882 | 93.607 | 99.416 | 99.625 | 99.428 |
| FeMn end | 0.135 | 0.177 | 0.198 | 0.512 | 0.143 | 1.862 | [illegible] | 0.019 | 1.917 | 0.231 | 0.201 | 0.276 |
| NbTa end | 0.162 | 0.282 | 0.267 | 1.537 | 0.657 | 4.690 | 3.574 | 0.099 | 4.476 | 0.353 | 0.174 | 0.296 |
| Nb+Ta | 0.003 | 0.006 | 0.005 | 0.031 | 0.013 | 0.094 | 0.071 | 0.002 | 0.089 | 0.007 | 0.003 | 0.006 |
| Fe+Mn | 0.003 | 0.004 | 0.004 | 0.010 | 0.003 | 0.037 | 0.027 | 0.000 | 0.038 | 0.005 | 0.004 | 0.006 |
| Comments: | EK & EL<br>same grain<br>associated<br>with<br>ferrocolumbite | | | DF - DH<br>same grain | | | DI - DL<br>same grain<br>spectacularly zoned (in Ta) crystal<br>associated with ferrocolumbite | | | DM & DN<br>same grain<br>core | rim | |

| | Big Whopper | | | | Big Whopper pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 97-185B | | | | 97-186A | | | | |
| | AH | AI | AJ | AK | DC | DM | DN | HB | HC |
| SnO2 | 98.55 | 95.77 | 99.14 | 99.26 | 96.53 | 99.61 | 98.94 | 98.63 | 95.45 |
| FeO | 0.13 | 0.38 | 0.02 | 0.10 | 0.51 | 0.01 | 0.06 | 0.15 | 0.29 |
| MnO | 0.06 | 0.18 | 0.00 | 0.02 | 0.03 | 0.01 | 0.07 | 0.00 | 0.20 |
| Nb2O5 | 0.33 | 0.80 | 0.19 | 0.10 | 0.23 | 0.06 | 0.40 | 0.09 | 0.63 |
| Ta2O5 | 0.99 | 2.79 | 0.23 | 0.82 | 2.55 | 0.36 | 0.63 | 0.83 | 3.33 |
| Total | 100.05 | 99.92 | 99.58 | 100.30 | 99.85 | 100.04 | 100.11 | 99.71 | 99.91 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | |
| Sn | 1.970 | 1.918 | 1.990 | 1.981 | 1.939 | 1.992 | 1.975 | 1.980 | 1.915 |
| Fe | 0.005 | 0.016 | 0.001 | 0.004 | 0.022 | 0.000 | 0.002 | 0.006 | 0.012 |
| Mn | 0.002 | 0.008 | 0.000 | 0.001 | 0.001 | 0.000 | 0.003 | 0.000 | 0.009 |
| Nb | 0.007 | 0.018 | 0.004 | 0.002 | 0.005 | 0.001 | 0.009 | 0.002 | 0.014 |
| Ta | 0.013 | 0.038 | 0.003 | 0.011 | 0.035 | 0.005 | 0.009 | 0.011 | 0.046 |
| Total | 1.999 | 1.998 | 1.999 | 1.999 | 2.001 | 1.999 | 1.998 | 2.000 | 1.995 |
| Sn end | 98.573 | 95.997 | 99.593 | 99.078 | 96.858 | 99.655 | 98.844 | 99.006 | 95.960 |
| FeMn end | 0.381 | 1.189 | 0.036 | 0.250 | 1.141 | 0.032 | 0.272 | 0.316 | 1.036 |
| NbTa end | 1.046 | 2.815 | 0.371 | 0.672 | 2.001 | 0.313 | 0.884 | 0.678 | 3.003 |
| Nb+Ta | 0.021 | 0.056 | 0.007 | 0.013 | 0.040 | 0.006 | 0.018 | 0.014 | 0.060 |
| Fe+Mn | 0.008 | 0.024 | 0.001 | 0.005 | 0.023 | 0.001 | 0.005 | 0.006 | 0.021 |
| Comments: | AH - AJ<br>same grain | | | | | DM & DN same grain | | | |
| | brown | brown | brown | colourless | | brown | colourless | | |

| | | **Big Whopper peg.** | | | | **Big Whopper pegmatite** | | |
|---|---|---|---|---|---|---|---|---|
| | | 97-186B | | | | 97-186C | | |
| | JE | JF | JG | CI | CK | CL | CM | CO |
| SnO2 | 99.84 | 99.42 | 99.13 | 98.94 | 99.71 | 100.25 | 99.47 | 99.43 |
| FeO | 0.05 | 0.03 | 0.00 | 0.10 | 0.07 | 0.01 | 0.09 | 0.05 |
| MnO | 0.04 | 0.04 | 0.07 | 0.06 | 0.03 | 0.02 | 0.02 | 0.04 |
| Nb2O5 | 0.01 | 0.01 | 0.01 | 0.68 | 0.13 | 0.01 | 0.12 | 0.28 |
| Ta2O5 | 0.25 | 0.37 | 0.45 | 0.65 | 0.73 | 0.10 | 0.65 | 0.41 |
| Total | 100.18 | 99.87 | 99.66 | 100.41 | 100.67 | 100.39 | 100.35 | 100.21 |
| | **Structural formulae based on 4 oxygens** | | | | | | | |
| Sn | 1.994 | 1.992 | 1.991 | 1.967 | 1.982 | 1.997 | 1.983 | 1.983 |
| Fe | 0.002 | 0.002 | 0.003 | 0.004 | 0.003 | 0.000 | 0.004 | 0.002 |
| Mn | 0.000 | 0.001 | 0.000 | 0.002 | 0.001 | 0.001 | 0.001 | 0.002 |
| Nb | 0.001 | 0.001 | 0.000 | 0.015 | 0.003 | 0.000 | 0.003 | 0.006 |
| Ta | 0.003 | 0.005 | 0.006 | 0.009 | 0.010 | 0.001 | 0.009 | 0.006 |
| Total | 2.000 | 2.000 | 2.000 | 1.997 | 1.999 | 2.000 | 1.999 | 1.999 |
| Sn end | 99.689 | 99.597 | 99.530 | 98.474 | 99.148 | 99.865 | 99.187 | 99.216 |
| FeMn end | 0.090 | 0.114 | 0.160 | 0.321 | 0.209 | 0.053 | 0.237 | 0.185 |
| NbTa end | 0.221 | 0.290 | 0.310 | 1.205 | 0.642 | 0.082 | 0.576 | 0.599 |
| Nb+Ta | 0.004 | 0.006 | 0.006 | 0.024 | 0.013 | 0.002 | 0.012 | 0.012 |
| Fe+Mn | 0.002 | 0.002 | 0.003 | 0.006 | 0.004 | 0.001 | 0.005 | 0.004 |
| Comments: | | JE - JG<br>same grain | | | cluster of grains<br>contains a few inclusions<br>pale colourless<br>brown | | | |

| | Big Whopper | | | | Big Whopper | | | | | Big Whopper pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-186X | | | | 97-186X | | | | | 97-186Z | | | | |
| | GA | GB | GD | GE | GF | GK | GN | GO | CA | CB | CC | CL | CM | CN |
| SnO2 | 99.63 | 99.33 | 99.50 | 99.25 | 99.08 | 99.72 | 98.21 | 98.38 | 99.29 | 95.39 | 100.11 | 99.66 | 97.69 | 100.21 |
| FeO | 0.02 | 0.00 | 0.00 | 0.04 | 0.02 | 0.04 | 0.05 | 0.11 | 0.03 | 0.31 | 0.01 | 0.02 | 0.06 | 0.03 |
| MnO | 0.00 | 0.01 | 0.02 | 0.03 | 0.00 | 0.01 | 0.02 | 0.00 | 0.05 | 0.27 | 0.01 | 0.00 | 0.09 | 0.00 |
| Nb2O5 | 0.00 | 0.00 | 0.02 | 0.01 | 0.05 | 0.04 | 0.12 | 0.12 | 0.08 | 1.24 | 0.00 | 0.02 | 0.80 | 0.06 |
| Ta2O5 | 0.13 | 0.14 | 0.25 | 0.57 | 0.23 | 0.35 | 0.86 | 0.65 | 0.54 | 2.07 | 0.06 | 0.14 | 0.74 | 0.21 |
| Total | 99.78 | 99.48 | 99.80 | 99.89 | 99.38 | 100.16 | 99.26 | 99.26 | 99.99 | 99.28 | 100.19 | 99.83 | 99.38 | 100.52 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.998 | 1.997 | 1.995 | 1.989 | 1.994 | 1.992 | 1.980 | 1.983 | 1.987 | 1.917 | 1.999 | 1.997 | 1.961 | 1.994 |
| Fe | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.002 | 0.002 | 0.005 | 0.001 | 0.013 | 0.000 | 0.001 | 0.003 | 0.001 |
| Mn | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.002 | 0.012 | 0.001 | 0.000 | 0.004 | 0.000 |
| Nb | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.003 | 0.003 | 0.002 | 0.028 | 0.000 | 0.000 | 0.018 | 0.001 |
| Ta | 0.002 | 0.002 | 0.003 | 0.008 | 0.003 | 0.005 | 0.012 | 0.009 | 0.007 | 0.028 | 0.001 | 0.002 | 0.010 | 0.003 |
| Total | 2.000 | 2.000 | 1.999 | 1.999 | 1.999 | 2.000 | 1.998 | 1.999 | 1.999 | 1.998 | 2.000 | 2.000 | 1.996 | 2.000 |
| Sn end | 99.882 | 99.881 | 99.760 | 99.456 | 99.742 | 99.616 | 99.127 | 99.185 | 99.373 | 95.940 | 99.917 | 99.856 | 98.246 | 99.717 |
| FeMn end | 0.032 | 0.023 | 0.045 | 0.146 | 0.046 | 0.105 | 0.142 | 0.233 | 0.167 | 1.229 | 0.040 | 0.032 | 0.334 | 0.067 |
| NbTa end | 0.087 | 0.095 | 0.195 | 0.399 | 0.211 | 0.279 | 0.731 | 0.582 | 0.460 | 2.832 | 0.043 | 0.112 | 1.420 | 0.216 |
| Nb+Ta | 0.002 | 0.002 | 0.004 | 0.008 | 0.004 | 0.006 | 0.015 | 0.012 | 0.009 | 0.057 | 0.001 | 0.002 | 0.028 | 0.004 |
| Fe+Mn | 0.001 | 0.000 | 0.001 | 0.003 | 0.001 | 0.002 | 0.003 | 0.005 | 0.003 | 0.025 | 0.001 | 0.001 | 0.007 | 0.001 |
| Comments: | GA & GB | | | | GE & GF | | GN & GO | | CA - CC | | | | dark | |
| | same grain | | | | same grain | | same grain | | same grain | | | brown | brown | colourless |
| | black | brown | | colourless | brown | | | | | | | | | |
| | | associated with | | | | | | | | | | | | |
| | | manganocolumbite | | | | | | | | | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | **Big Whopper pegmatite** | | | | | | | **Big Whopper** | |
| | 97-186vii | | | | | | | 97-198 | |
| | AA | AB | AC | AD | AE | AG | AI | GF | GG |
| SnO2 | 99.21 | 99.51 | 99.50 | 98.95 | 98.51 | 98.53 | 99.24 | 99.26 | 99.71 |
| FeO | 0.10 | 0.05 | 0.08 | 0.06 | 0.08 | 0.23 | 0.09 | 0.05 | 0.05 |
| MnO | 0.01 | 0.00 | 0.01 | 0.01 | 0.04 | 0.00 | 0.00 | 0.03 | 0.01 |
| Nb2O5 | 0.06 | 0.05 | 0.04 | 0.04 | 0.25 | 0.09 | 0.02 | 0.13 | 0.07 |
| Ta2O5 | 0.62 | 0.40 | 0.56 | 0.61 | 0.70 | 1.32 | 0.37 | 0.50 | 0.33 |
| Total | 99.82 | 99.92 | 100.06 | 99.56 | 99.21 | 99.85 | 99.61 | 99.96 | 100.18 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | |
| Sn | 1.986 | 1.991 | 1.988 | 1.987 | 1.978 | 1.970 | 1.991 | 1.986 | 1.991 |
| Fe | 0.004 | 0.002 | 0.003 | 0.003 | 0.003 | 0.010 | 0.004 | 0.002 | 0.002 |
| Mn | 0.000 | 0.000 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.000 |
| Nb | 0.001 | 0.001 | 0.001 | 0.001 | 0.006 | 0.002 | 0.000 | 0.003 | 0.002 |
| Ta | 0.008 | 0.005 | 0.008 | 0.008 | 0.010 | 0.018 | 0.005 | 0.007 | 0.004 |
| Total | 2.000 | 1.999 | 2.000 | 1.999 | 1.999 | 2.000 | 2.001 | 1.999 | 2.000 |
| Sn end | 99.302 | 99.559 | 99.403 | 99.385 | 98.986 | 98.517 | 99.524 | 99.355 | 99.558 |
| FeMn end | 0.212 | 0.113 | 0.174 | 0.152 | 0.250 | 0.478 | 0.202 | 0.160 | 0.136 |
| NbTa end | 0.486 | 0.328 | 0.423 | 0.463 | 0.764 | 1.005 | 0.274 | 0.485 | 0.305 |
| Nb+Ta | 0.010 | 0.007 | 0.008 | 0.009 | 0.015 | 0.020 | 0.005 | 0.010 | 0.006 |
| Fe+Mn | 0.004 | 0.002 | 0.003 | 0.003 | 0.005 | 0.010 | 0.004 | 0.003 | 0.003 |
| Comments: | | AA - AC | | AD & AE same grain | | | | GF & GG | |
| | | same grain | | light | dark | | colourless | same grain | |
| | | | | | | colourless | | brown | brown |

| | School of Fish | | | | | | | | | Bob's pegmatite | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-264 | | | | | | | | | 97-BP1 | | | | |
| | HA | HB | HR | HH | HI | HJ | HN | HO | HQ | BH | BI | BJ | BO | BP |
| SnO2 | 100.18 | 100.15 | 100.19 | 100.43 | 92.85 | 100.80 | 96.98 | 98.10 | 96.54 | 94.66 | 96.72 | 95.25 | 99.63 | 98.96 |
| FeO | 0.01 | 0.03 | 0.01 | 0.07 | 0.72 | 0.00 | 0.59 | 0.36 | 0.63 | 0.88 | 0.50 | 0.68 | 0.07 | 0.13 |
| MnO | 0.01 | 0.00 | 0.00 | 0.00 | 0.35 | 0.00 | 0.01 | 0.02 | 0.01 | 0.06 | 0.04 | 0.04 | 0.00 | 0.01 |
| Nb2O5 | 0.00 | 0.11 | 0.00 | 0.02 | 1.69 | 0.03 | 0.19 | 0.11 | 0.17 | 0.60 | 0.30 | 0.47 | 0.05 | 0.05 |
| Ta2O5 | 0.10 | 0.19 | 0.12 | 0.36 | 4.74 | 0.11 | 3.04 | 1.93 | 3.01 | 4.33 | 2.58 | 3.42 | 0.38 | 0.58 |
| Total | 100.30 | 100.48 | 100.32 | 100.88 | 100.34 | 100.94 | 100.80 | 100.52 | 100.36 | 100.53 | 100.14 | 99.85 | 100.13 | 99.72 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.998 | 1.993 | 1.998 | 1.992 | 1.850 | 1.997 | 1.931 | 1.956 | 1.930 | 1.890 | 1.936 | 1.913 | 1.991 | 1.986 |
| Fe | 0.000 | 0.001 | 0.000 | 0.003 | 0.030 | 0.000 | 0.024 | 0.015 | 0.026 | 0.037 | 0.021 | 0.028 | 0.003 | 0.005 |
| Mn | 0.000 | 0.000 | 0.000 | 0.000 | 0.015 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.002 | 0.002 | 0.000 | 0.000 |
| Nb | 0.000 | 0.003 | 0.000 | 0.001 | 0.038 | 0.001 | 0.004 | 0.002 | 0.004 | 0.014 | 0.007 | 0.011 | 0.001 | 0.001 |
| Ta | 0.001 | 0.003 | 0.002 | 0.005 | 0.064 | 0.001 | 0.041 | 0.026 | 0.041 | 0.059 | 0.035 | 0.047 | 0.005 | 0.008 |
| Total | 2.000 | 1.999 | 2.000 | 2.000 | 1.997 | 1.999 | 2.001 | 2.001 | 2.002 | 2.002 | 2.001 | 2.001 | 2.000 | 2.001 |
| Sn end | 99.893 | 99.685 | 99.903 | 99.586 | 92.628 | 99.891 | 96.481 | 97.775 | 96.422 | 94.418 | 96.783 | 95.624 | 99.551 | 99.259 |
| FeMn end | 0.038 | 0.056 | 0.015 | 0.148 | 2.238 | 0.000 | 1.242 | 0.793 | 1.330 | 1.962 | 1.117 | 1.502 | 0.136 | 0.293 |
| NbTa end | 0.069 | 0.259 | 0.082 | 0.267 | 5.134 | 0.109 | 2.277 | 1.432 | 2.248 | 3.620 | 2.100 | 2.874 | 0.313 | 0.449 |
| Nb+Ta | 0.001 | 0.005 | 0.002 | 0.005 | 0.103 | 0.002 | 0.046 | 0.029 | 0.045 | 0.072 | 0.042 | 0.057 | 0.006 | 0.009 |
| Fe+Mn | 0.001 | 0.001 | 0.000 | 0.003 | 0.045 | 0.000 | 0.025 | 0.016 | 0.027 | 0.039 | 0.022 | 0.030 | 0.003 | 0.006 |
| Comments: | HA, HB & HR<br>same grain<br>few inclusions | | | | HH - HJ<br>same grain | | HN & HO<br>same grain<br>mantles ferrotantalite | | | | | | BO & BP<br>same grain | |

| | Bob's pegmatite | | | Bob's peg. | | | | | | Bob's pegmatite | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-BP2 | | | 97-BP3 | | | | | | 97-BP3 | | | | | |
| | AA | AB | BG | RA | RC | RD | RE | RF | RG | QA | QH | QI | QK | QJ |
| SnO2 | 95.11 | 98.04 | 97.46 | 98.15 | 97.04 | 98.69 | 97.71 | 97.02 | 98.43 | 99.54 | 100.25 | 100.40 | 94.68 | 99.32 |
| FeO | 0.65 | 0.23 | 0.33 | 0.09 | 0.29 | 0.07 | 0.13 | 0.32 | 0.15 | 0.15 | 0.06 | 0.05 | 0.74 | 0.17 |
| MnO | 0.07 | 0.04 | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 | 0.02 | 0.02 | 0.00 | 0.01 | 0.01 | 0.06 | 0.02 |
| Nb2O5 | 0.30 | 0.13 | 0.11 | 0.13 | 0.13 | 0.07 | 0.08 | 0.15 | 0.26 | 0.28 | 0.08 | 0.06 | 0.50 | 0.68 |
| Ta2O5 | 3.62 | 1.42 | 1.65 | 0.35 | 1.53 | 0.44 | 0.77 | 1.51 | 2.09 | 0.45 | 0.29 | 0.39 | 3.74 | 0.22 |
| | | | | | | | | | | | | | | |
| Total | 99.75 | 99.86 | 99.57 | 98.73 | 99.02 | 99.27 | 98.69 | 99.01 | 100.95 | 100.43 | 100.70 | 100.91 | 99.72 | 100.41 |
| | | | | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.914 | 1.966 | 1.961 | 1.988 | 1.963 | 1.989 | 1.982 | 1.963 | 1.954 | 1.981 | 1.991 | 1.991 | 1.905 | 1.973 |
| Fe | 0.027 | 0.010 | 0.014 | 0.004 | 0.012 | 0.003 | 0.005 | 0.013 | 0.006 | 0.006 | 0.003 | 0.002 | 0.031 | 0.007 |
| Mn | 0.003 | 0.002 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.003 | 0.001 |
| Nb | 0.007 | 0.003 | 0.003 | 0.003 | 0.003 | 0.001 | 0.002 | 0.003 | 0.006 | 0.006 | 0.002 | 0.001 | 0.011 | 0.015 |
| Ta | 0.050 | 0.019 | 0.023 | 0.005 | 0.021 | 0.006 | 0.011 | 0.021 | 0.028 | 0.006 | 0.004 | 0.005 | 0.051 | 0.003 |
| | | | | | | | | | | | | | | |
| Total | 2.001 | 2.000 | 2.001 | 2.000 | 2.001 | 2.000 | 2.000 | 2.001 | 1.995 | 2.000 | 2.000 | 2.000 | 2.001 | 1.999 |
| | | | | | | | | | | | | | | |
| Sn end | 95.661 | 98.314 | 98.005 | 99.402 | 98.126 | 99.471 | 99.093 | 98.078 | 97.936 | 99.050 | 99.557 | 99.554 | 95.173 | 98.691 |
| FeMn end | 1.512 | 0.567 | 0.739 | 0.206 | 0.673 | 0.150 | 0.279 | 0.715 | 0.353 | 0.326 | 0.154 | 0.119 | 1.695 | 0.396 |
| NbTa end | 2.827 | 1.119 | 1.256 | 0.391 | 1.201 | 0.379 | 0.628 | 1.207 | 1.711 | 0.624 | 0.288 | 0.327 | 3.132 | 0.913 |
| | | | | | | | | | | | | | | |
| Nb+Ta | 0.057 | 0.022 | 0.025 | 0.008 | 0.024 | 0.008 | 0.013 | 0.024 | 0.034 | 0.012 | 0.006 | 0.007 | 0.063 | 0.018 |
| Fe+Mn | 0.030 | 0.011 | 0.015 | 0.004 | 0.013 | 0.003 | 0.006 | 0.014 | 0.007 | 0.007 | 0.003 | 0.002 | 0.034 | 0.008 |
| | | | | | | | | | | | | | | |
| Comments: | AA & AB<br>same grain | | | brown | | RD & RE<br>same grain | | | | | QH & QI<br>same grain<br>brown | | | |

| | **Big Whopper pegmatite** | | | | **Big Whopper peg.** | | | **Whopper** |
|---|---|---|---|---|---|---|---|---|
| | 97-BW2 | | | | 97-BW3 | | | 97-BW4 |
| | LA | LB | LC | LD | BA | BB | BF | LK |
| SnO2 | 97.39 | 98.50 | 99.64 | 99.49 | 99.04 | 99.64 | 99.48 | 100.06 |
| FeO | 0.28 | 0.13 | 0.04 | 0.01 | 0.04 | 0.01 | 0.01 | 0.00 |
| MnO | 0.04 | 0.02 | 0.01 | 0.00 | 0.12 | 0.01 | 0.01 | 0.02 |
| Nb2O5 | 0.28 | 0.16 | 0.03 | 0.01 | 0.22 | 0.02 | 0.05 | 0.00 |
| Ta2O5 | 1.28 | 0.68 | 0.22 | 0.10 | 0.83 | 0.11 | 0.11 | 0.11 |
| Total | 99.27 | 99.47 | 99.94 | 99.61 | 99.87 | 99.75 | 99.59 | 100.18 |
| | **Structural formulae based on 4 oxygens** | | | | | | | |
| Sn | 1.963 | 1.981 | 1.994 | 1.998 | 1.976 | 1.997 | 1.996 | 1.998 |
| Fe | 0.012 | 0.005 | 0.002 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 |
| Mn | 0.002 | 0.001 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.001 |
| Nb | 0.006 | 0.004 | 0.001 | 0.000 | 0.005 | 0.000 | 0.001 | 0.000 |
| Ta | 0.018 | 0.009 | 0.003 | 0.001 | 0.011 | 0.002 | 0.002 | 0.001 |
| Total | 2.001 | 2.000 | 2.000 | 2.000 | 1.999 | 2.000 | 2.000 | 2.000 |
| Sn end | 98.128 | 99.051 | 99.725 | 99.903 | 98.852 | 99.863 | 99.821 | 99.896 |
| FeMn end | 0.671 | 0.304 | 0.088 | 0.019 | 0.334 | 0.036 | 0.042 | 0.032 |
| NbTa end | 1.201 | 0.645 | 0.187 | 0.078 | 0.814 | 0.101 | 0.137 | 0.072 |
| Nb+Ta | 0.024 | 0.013 | 0.004 | 0.002 | 0.016 | 0.002 | 0.003 | 0.001 |
| Fe+Mn | 0.013 | 0.006 | 0.002 | 0.000 | 0.007 | 0.001 | 0.001 | 0.001 |
| Comments: | LA & LB<br>same grain | | | | | all colourless | | colourless<br>few<br>tiny<br>inclusions |

**Big Whopper**

97-BW5

| | HO | HP | HQ | HR | HS | HU | HV | HW |
|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.40 | 98.55 | 99.38 | 99.50 | 93.97 | 94.76 | 99.30 | 94.66 |
| FeO | 0.13 | 0.16 | 0.07 | 0.01 | 0.79 | 0.70 | 0.07 | 0.83 |
| MnO | 0.02 | 0.00 | 0.00 | 0.00 | 0.12 | 0.08 | 0.01 | 0.10 |
| Nb2O5 | 0.05 | 0.13 | 0.07 | 0.04 | 0.96 | 0.95 | 0.03 | 1.87 |
| Ta2O5 | 0.62 | 0.53 | 0.22 | 0.15 | 3.80 | 3.46 | 0.28 | 2.58 |
| Total | 100.22 | 99.37 | 99.74 | 99.71 | 99.64 | 99.95 | 99.69 | 100.04 |
| **Structural formulae based on 4 oxygens** | | | | | | | | |
| Sn | 1.985 | 1.984 | 1.993 | 1.996 | 1.888 | 1.898 | 1.993 | 1.884 |
| Fe | 0.005 | 0.007 | 0.003 | 0.000 | 0.033 | 0.029 | 0.003 | 0.035 |
| Mn | 0.001 | 0.000 | 0.000 | 0.000 | 0.005 | 0.003 | 0.001 | 0.004 |
| Nb | 0.001 | 0.003 | 0.002 | 0.001 | 0.022 | 0.022 | 0.001 | 0.042 |
| Ta | 0.008 | 0.007 | 0.003 | 0.002 | 0.052 | 0.047 | 0.004 | 0.035 |
| Total | 2.001 | 2.001 | 2.000 | 1.999 | 2.001 | 1.999 | 2.001 | 2.000 |
| Sn end | 99.214 | 99.159 | 99.628 | 99.825 | 94.388 | 94.918 | 99.597 | 94.198 |
| FeMn end | 0.308 | 0.329 | 0.143 | 0.023 | 1.914 | 1.643 | 0.179 | 1.944 |
| NbTa end | 0.477 | 0.512 | 0.229 | 0.152 | 3.698 | 3.440 | 0.224 | 3.859 |
| Nb+Ta | 0.010 | 0.010 | 0.005 | 0.003 | 0.074 | 0.069 | 0.004 | 0.077 |
| Fe+Mn | 0.006 | 0.007 | 0.003 | 0.000 | 0.038 | 0.033 | 0.004 | 0.039 |
| Comments: | HO & HP | | HQ - HS | | | | HV & HW | |
| | same grain | | same grain | | | | same grain | |
| | colourless | | colourless | | brown | brown | brown | |
| | | | large euhedral zoned crystals | | | | | dark brown |
| | | | with ferrocolumbite inclusions | | | | | |

| | **Big Whopper pegmatite**<br>97-BW6 | | | | **Big Whopper pegmatite**<br>97-BW7B | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | PA | PB | PC | PD | JE | JF | JH | LE | XX1 | XX2 | XX3 | XX4 | XX5 | XX6 |
| SnO2 | 96.19 | 99.32 | 98.52 | 89.58 | 98.13 | 96.60 | 96.88 | 98.57 | 98.87 | 97.64 | 97.90 | 97.03 | 98.94 | 98.89 |
| FeO | 0.23 | 0.03 | 0.02 | 0.46 | 0.20 | 0.31 | 0.33 | 0.15 | 0.06 | 0.18 | 0.14 | 0.26 | 0.16 | 0.14 |
| MnO | 0.26 | 0.00 | 0.02 | 0.77 | 0.01 | 0.08 | 0.06 | 0.01 | 0.00 | 0.02 | 0.02 | 0.06 | 0.00 | 0.02 |
| Nb2O5 | 0.87 | 0.05 | 0.01 | 1.87 | 0.08 | 0.43 | 0.34 | 0.07 | 0.04 | 0.12 | 0.11 | 0.32 | 0.04 | 0.05 |
| Ta2O5 | 2.20 | 0.22 | 0.19 | 5.75 | 1.12 | 1.93 | 2.01 | 0.96 | 0.34 | 1.02 | 0.80 | 1.83 | 0.87 | 0.59 |
| Total | 99.76 | 99.61 | 98.76 | 98.43 | 99.54 | 99.34 | 99.62 | 99.76 | 99.30 | 98.98 | 98.98 | 99.51 | 100.00 | 99.69 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Sn | 1.927 | 1.994 | 1.995 | 1.820 | 1.974 | 1.946 | 1.948 | 1.978 | 1.992 | 1.975 | 1.979 | 1.952 | 1.981 | 1.985 |
| Fe | 0.010 | 0.001 | 0.001 | 0.020 | 0.008 | 0.013 | 0.014 | 0.006 | 0.003 | 0.008 | 0.006 | 0.011 | 0.007 | 0.006 |
| Mn | 0.011 | 0.000 | 0.001 | 0.033 | 0.000 | 0.003 | 0.003 | 0.000 | 0.000 | 0.001 | 0.001 | 0.003 | 0.000 | 0.001 |
| Nb | 0.020 | 0.001 | 0.000 | 0.043 | 0.002 | 0.010 | 0.008 | 0.002 | 0.001 | 0.003 | 0.003 | 0.007 | 0.001 | 0.001 |
| Ta | 0.030 | 0.003 | 0.003 | 0.080 | 0.015 | 0.026 | 0.028 | 0.013 | 0.005 | 0.014 | 0.011 | 0.025 | 0.012 | 0.008 |
| Total | 1.998 | 2.000 | 2.000 | 1.996 | 2.000 | 1.999 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 1.999 | 2.000 | 2.001 |
| Sn end | 98.128 | 98.128 | 98.128 | 98.128 | 98.704 | 97.368 | 97.406 | 98.923 | 99.595 | 98.749 | 98.974 | 97.684 | 99.035 | 99.203 |
| FeMn end | 0.671 | 0.671 | 0.671 | 0.671 | 0.433 | 0.816 | 0.837 | 0.339 | 0.129 | 0.410 | 0.342 | 0.688 | 0.332 | 0.339 |
| NbTa end | 1.201 | 1.201 | 1.201 | 1.201 | 0.864 | 1.815 | 1.757 | 0.738 | 0.276 | 0.842 | 0.684 | 1.628 | 0.634 | 0.458 |
| Nb+Ta | 0.050 | 0.004 | 0.003 | 0.123 | 0.017 | 0.036 | 0.035 | 0.015 | 0.006 | 0.017 | 0.014 | 0.033 | 0.013 | 0.009 |
| Fe+Mn | 0.021 | 0.001 | 0.002 | 0.053 | 0.009 | 0.016 | 0.017 | 0.007 | 0.003 | 0.008 | 0.007 | 0.014 | 0.007 | 0.007 |
| Comments: | PA & PB<br>same grain<br>light brown | brown | PC & PD<br>same grain<br>light brown | dark brown | JE, JF & JH<br>same giant grain as traverse XX | brown | brown | | XX traverse is through a 7700 µm long crystal<br>with an early Ta-poor unzoned part and<br>a later oscillatory zoned Ta-rich part | | | | | |

**Big Whopper pegmatite**

97-BW7B

| | XX7 | XX8 | XX9 | XX10 | XX11 | XX12 | XX13 | XX14 | XX15 | XX16 | XX17 | XX18 | XX19 | XX20 | XX21 | XX22 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.14 | 98.86 | 98.65 | 98.86 | 99.30 | 99.30 | 99.22 | 99.33 | 99.18 | 98.53 | 96.21 | 96.45 | 96.72 | 96.05 | 94.63 | 94.89 |
| FeO | 0.06 | 0.05 | 0.02 | 0.13 | 0.01 | 0.02 | 0.04 | 0.03 | 0.02 | 0.01 | 0.36 | 0.32 | 0.32 | 0.45 | 0.60 | 0.52 |
| MnO | 0.01 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.07 | 0.07 | 0.06 | 0.07 | 0.15 | 0.14 |
| Nb2O5 | 0.06 | 0.06 | 0.02 | 0.06 | 0.01 | 0.00 | 0.01 | 0.02 | 0.00 | 0.06 | 0.71 | 0.61 | 0.66 | 0.99 | 0.96 | 0.92 |
| Ta2O5 | 0.40 | 0.35 | 0.22 | 0.24 | 0.10 | 0.18 | 0.05 | 0.13 | 0.22 | 0.10 | 1.92 | 1.63 | 1.40 | 1.94 | 3.21 | 2.97 |
| Total | 99.66 | 99.34 | 98.94 | 99.29 | 99.42 | 99.50 | 99.31 | 99.51 | 99.43 | 98.70 | 99.26 | 99.08 | 99.15 | 99.50 | 99.55 | 99.43 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | | |
| Sn | 1.990 | 1.991 | 1.995 | 1.991 | 1.998 | 1.997 | 1.998 | 1.996 | 1.996 | 1.996 | 1.938 | 1.946 | 1.949 | 1.928 | 1.902 | 1.909 |
| Fe | 0.002 | 0.002 | 0.001 | 0.005 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.015 | 0.014 | 0.013 | 0.019 | 0.025 | 0.022 |
| Mn | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.003 | 0.003 | 0.002 | 0.003 | 0.006 | 0.006 |
| Nb | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.016 | 0.014 | 0.015 | 0.022 | 0.022 | 0.021 |
| Ta | 0.005 | 0.005 | 0.003 | 0.003 | 0.001 | 0.002 | 0.001 | 0.002 | 0.003 | 0.001 | 0.026 | 0.022 | 0.019 | 0.027 | 0.044 | 0.041 |
| Total | 2.000 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 2.000 | 1.998 | 1.999 | 1.999 | 1.999 | 1.999 | 1.999 |
| Sn end | 99.520 | 99.545 | 99.739 | 99.495 | 99.896 | 99.833 | 99.881 | 99.819 | 99.782 | 99.824 | 96.964 | 97.357 | 97.493 | 96.443 | 95.109 | 95.510 |
| FeMn end | 0.135 | 0.146 | 0.081 | 0.266 | 0.027 | 0.044 | 0.076 | 0.068 | 0.068 | 0.036 | 0.911 | 0.828 | 0.792 | 1.107 | 1.593 | 1.410 |
| NbTa end | 0.345 | 0.309 | 0.179 | 0.239 | 0.077 | 0.122 | 0.043 | 0.113 | 0.150 | 0.140 | 2.125 | 1.815 | 1.714 | 2.450 | 3.298 | 3.080 |
| Nb+Ta | 0.007 | 0.006 | 0.004 | 0.005 | 0.002 | 0.002 | 0.001 | 0.002 | 0.003 | 0.003 | 0.042 | 0.036 | 0.034 | 0.049 | 0.066 | 0.062 |
| Fe+Mn | 0.003 | 0.003 | 0.002 | 0.005 | 0.001 | 0.001 | 0.002 | 0.001 | 0.001 | 0.001 | 0.018 | 0.017 | 0.016 | 0.0[illegible] | 0.032 | 0.028 |

Comments:

XX traverse is through a 7700 µm long crystal
with an early Ta-poor unzoned part and
a later oscillatory zoned Ta-rich part

**Big Whopper pegmatite**

97-BW7B

| | XX23 | XX24 | XX25 | XX26 | XX27 | XX28 | XX29 | XX30 | XX31 | XX32 | XX33 | XX34 | XX35 | XX36 | XX37 | XX38 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 95.00 | 94.22 | 94.60 | 94.61 | 95.28 | 94.39 | 94.83 | 93.73 | 94.80 | 93.62 | 95.98 | 96.20 | 97.55 | 97.37 | 95.71 | 97.00 |
| FeO | 0.42 | 0.51 | 0.62 | 0.53 | 0.47 | 0.60 | 0.54 | 0.72 | 0.58 | 0.62 | 0.47 | 0.35 | 0.29 | 0.28 | 0.51 | 0.25 |
| MnO | 0.12 | 0.11 | 0.16 | 0.16 | 0.12 | 0.15 | 0.15 | 0.17 | 0.13 | 0.15 | 0.10 | 0.09 | 0.02 | 0.02 | 0.12 | 0.04 |
| Nb2O5 | 0.73 | 0.67 | 0.87 | 0.77 | 0.61 | 0.92 | 0.68 | 1.00 | 0.63 | 1.08 | 0.78 | 0.74 | 0.70 | 0.59 | 1.47 | 0.20 |
| Ta2O5 | 2.46 | 2.95 | 3.40 | 3.21 | 2.89 | 3.41 | 3.28 | 4.06 | 3.37 | 3.53 | 2.40 | 1.98 | 0.91 | 1.11 | 1.48 | 1.42 |
| Total | 98.74 | 98.46 | 99.65 | 99.28 | 99.36 | 99.46 | 99.47 | 99.67 | 99.51 | 98.99 | 99.72 | 99.35 | 99.46 | 99.37 | 99.29 | 98.91 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.925 | 1.916 | 1.901 | 1.908 | 1.921 | 1.900 | 1.910 | 1.883 | 1.909 | 1.892 | 1.925 | 1.936 | 1.958 | 1.958 | 1.920 | 1.964 |
| Fe | 0.018 | 0.022 | 0.026 | 0.022 | 0.020 | 0.025 | 0.023 | 0.030 | 0.025 | 0.026 | 0.020 | 0.015 | 0.012 | 0.012 | 0.022 | 0.011 |
| Mn | 0.005 | 0.005 | 0.007 | 0.007 | 0.005 | 0.006 | 0.006 | 0.007 | 0.006 | 0.006 | 0.004 | 0.004 | 0.001 | 0.001 | 0.005 | 0.002 |
| Nb | 0.017 | 0.016 | 0.020 | 0.018 | 0.014 | 0.021 | 0.016 | 0.023 | 0.014 | 0.025 | 0.018 | 0.017 | 0.016 | 0.013 | 0.033 | 0.005 |
| Ta | 0.034 | 0.041 | 0.047 | 0.044 | 0.040 | 0.047 | 0.045 | 0.056 | 0.046 | 0.049 | 0.033 | 0.027 | 0.012 | 0.015 | 0.020 | 0.020 |
| Total | 1.999 | 1.999 | 2.000 | 1.999 | 1.999 | 1.999 | 1.999 | 1.999 | 2.000 | 1.998 | 1.999 | 1.998 | 1.999 | 1.999 | 2.000 | 2.000 |
| Sn end | 96.298 | 95.862 | 95.028 | 95.452 | 96.070 | 95.031 | 95.520 | 94.202 | 95.450 | 94.701 | 96.291 | 96.880 | 97.948 | 97.935 | 95.994 | 98.184 |
| FeMn end | 1.162 | 1.315 | 1.658 | 1.460 | 1.249 | 1.583 | 1.451 | 1.879 | 1.516 | 1.629 | 1.183 | 0.915 | 0.634 | 0.635 | 1.324 | 0.608 |
| NbTa end | 2.540 | 2.823 | 3.313 | 3.088 | 2.682 | 3.385 | 3.029 | 3.920 | 3.034 | 3.670 | 2.526 | 2.205 | 1.417 | 1.430 | 2.682 | 1.208 |
| Nb+Ta | 0.051 | 0.056 | 0.066 | 0.062 | 0.054 | 0.068 | 0.061 | 0.078 | 0.061 | 0.073 | 0.051 | 0.044 | 0.028 | 0.029 | 0.054 | 0.024 |
| Fe+Mn | 0.023 | 0.026 | 0.033 | 0.029 | 0.025 | 0.032 | 0.029 | 0.038 | 0.030 | 0.033 | 0.024 | 0.018 | 0.013 | 0.013 | 0.026 | 0.012 |

Comments:

XX traverse is through a 7700 μm long crystal
with an early Ta-poor unzoned part and
a later oscillatory zoned Ta-rich part

**Big Whopper pegmatite**

97-BW7B

| | XX39 | XX40 | XX41 | XX42 | XX43 | XX44 | XX45 | XX46 | XX47 | XX48 | XX49 | XX50 | XX51 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 94.45 | 96.16 | 96.72 | 97.65 | 94.52 | 98.59 | 96.25 | 93.00 | 97.03 | 96.64 | 98.68 | 98.80 | 98.26 |
| FeO | 0.63 | 0.39 | 0.35 | 0.15 | 0.62 | 0.16 | 0.43 | 0.77 | 0.39 | 0.33 | 0.17 | 0.04 | 0.12 |
| MnO | 0.12 | 0.05 | 0.05 | 0.00 | 0.13 | 0.00 | 0.05 | 0.12 | 0.02 | 0.04 | 0.02 | 0.01 | 0.01 |
| Nb2O5 | 0.93 | 0.81 | 0.76 | 0.07 | 0.81 | 0.04 | 1.40 | 1.22 | 0.17 | 1.13 | 0.56 | 0.00 | 0.11 |
| Ta2O5 | 3.38 | 1.82 | 1.35 | 0.73 | 3.42 | 0.87 | 1.21 | 3.68 | 1.93 | 0.97 | 0.46 | 0.13 | 0.66 |
| Total | 99.51 | 99.24 | 99.23 | 98.59 | 99.50 | 99.66 | 99.33 | 98.79 | 99.54 | 99.10 | 99.89 | 98.98 | 99.17 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.900 | 1.936 | 1.947 | 1.982 | 1.902 | 1.981 | 1.930 | 1.882 | 1.953 | 1.944 | 1.972 | 1.997 | 1.983 |
| Fe | 0.027 | 0.016 | 0.015 | 0.006 | 0.026 | 0.007 | 0.018 | 0.033 | 0.016 | 0.014 | 0.007 | 0.001 | 0.005 |
| Mn | 0.005 | 0.002 | 0.002 | 0.000 | 0.005 | 0.000 | 0.002 | 0.005 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 |
| Nb | 0.021 | 0.019 | 0.017 | 0.002 | 0.018 | 0.001 | 0.032 | 0.028 | 0.004 | 0.026 | 0.013 | 0.000 | 0.003 |
| Ta | 0.046 | 0.025 | 0.018 | 0.010 | 0.047 | 0.012 | 0.016 | 0.051 | 0.026 | 0.013 | 0.006 | 0.002 | 0.009 |
| Total | 1.999 | 1.998 | 2.000 | 2.000 | 1.999 | 2.000 | 1.998 | 1.999 | 2.001 | 1.998 | 1.999 | 2.001 | 2.000 |
| Sn end | 95.034 | 96.887 | 97.361 | 99.099 | 95.146 | 99.027 | 96.579 | 94.153 | 97.616 | 97.281 | 98.658 | 99.808 | 99.142 |
| FeMn end | 1.592 | 0.935 | 0.848 | 0.319 | 1.580 | 0.327 | 1.003 | 1.906 | 0.870 | 0.765 | 0.399 | 0.100 | 0.275 |
| NbTa end | 3.373 | 2.177 | 1.791 | 0.582 | 3.274 | 0.647 | 2.418 | 3.941 | 1.514 | 1.954 | 0.943 | 0.092 | 0.583 |
| Nb+Ta | 0.067 | 0.044 | 0.036 | 0.012 | 0.065 | 0.013 | 0.048 | 0.079 | 0.030 | 0.039 | 0.019 | 0.002 | 0.012 |
| Fe+Mn | 0.032 | 0.019 | 0.017 | 0.006 | 0.032 | 0.007 | 0.020 | 0.038 | 0.017 | 0.015 | 0.008 | 0.002 | 0.006 |

Comments: XX traverse is through a 7700 µm long
crystal with an early Ta-poor unzoned
part and a later oscillatory zoned Ta-rich part

**Big Whopper pegmatite**

97-BW8

| | FA | FB | FH | FI | FJ | EA | EB | EC | ED | EE | EF | EG | EI | EJ | EK |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 95.10 | 98.93 | 97.89 | 96.86 | 96.57 | 97.99 | 98.02 | 99.75 | 95.94 | 95.89 | 99.13 | 99.38 | 99.39 | 94.62 | 99.77 |
| FeO | 0.72 | 0.12 | 0.20 | 0.33 | 0.17 | 0.19 | 0.02 | 0.01 | 0.07 | 0.06 | 0.02 | 0.01 | 0.05 | 0.63 | 0.01 |
| MnO | 0.02 | 0.01 | 0.05 | 0.10 | 0.17 | 0.10 | 0.08 | 0.00 | 0.29 | 0.31 | 0.02 | 0.00 | 0.00 | 0.19 | 0.00 |
| Nb2O5 | 0.40 | 0.10 | 0.19 | 0.37 | 1.05 | 0.51 | 0.62 | 0.04 | 1.40 | 0.96 | 0.16 | 0.03 | 0.05 | 0.83 | 0.00 |
| Ta2O5 | 3.58 | 0.50 | 1.40 | 2.40 | 1.11 | 1.26 | 0.57 | 0.17 | 1.70 | 2.12 | 0.38 | 0.28 | 0.22 | 3.93 | 0.06 |
| Total | 99.82 | 99.66 | 99.73 | 100.05 | 99.07 | 100.05 | 99.31 | 99.97 | 99.40 | 99.34 | 99.70 | 99.69 | 99.70 | 100.20 | 99.84 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.912 | 1.986 | 1.965 | 1.940 | 1.944 | 1.958 | 1.971 | 1.996 | 1.924 | 1.929 | 1.988 | 1.994 | 1.994 | 1.892 | 1.999 |
| Fe | 0.030 | 0.005 | 0.008 | 0.014 | 0.007 | 0.008 | 0.001 | 0.000 | 0.003 | 0.002 | 0.001 | 0.001 | 0.002 | 0.026 | 0.000 |
| Mn | 0.001 | 0.000 | 0.002 | 0.004 | 0.007 | 0.004 | 0.003 | 0.000 | 0.012 | 0.013 | 0.001 | 0.000 | 0.000 | 0.008 | 0.000 |
| Nb | 0.009 | 0.002 | 0.004 | 0.008 | 0.024 | 0.012 | 0.014 | 0.001 | 0.032 | 0.022 | 0.004 | 0.001 | 0.001 | 0.019 | 0.000 |
| Ta | 0.049 | 0.007 | 0.019 | 0.033 | 0.015 | 0.017 | 0.008 | 0.002 | 0.023 | 0.029 | 0.005 | 0.004 | 0.003 | 0.054 | 0.001 |
| Total | 2.001 | 2.000 | 1.999 | 1.999 | 1.997 | 1.999 | 1.997 | 1.999 | 1.994 | 1.995 | 1.998 | 1.999 | 2.000 | 1.999 | 2.000 |
| Sn end | 95.540 | 99.272 | 98.292 | 97.048 | 97.315 | 97.960 | 98.698 | 99.820 | 96.475 | 96.667 | 99.489 | 99.755 | 99.692 | 94.659 | 99.945 |
| FeMn end | 1.551 | 0.274 | 0.530 | 0.894 | 0.717 | 0.606 | 0.205 | 0.023 | 0.763 | 0.782 | 0.070 | 0.025 | 0.107 | 1.715 | 0.017 |
| NbTa end | 2.909 | 0.454 | 1.178 | 2.059 | 1.968 | 1.433 | 1.097 | 0.157 | 2.762 | 2.551 | 0.441 | 0.220 | 0.201 | 3.626 | 0.038 |
| Nb+Ta | 0.058 | 0.009 | 0.024 | 0.041 | 0.039 | 0.029 | 0.022 | 0.003 | 0.055 | 0.051 | 0.009 | 0.004 | 0.004 | 0.072 | 0.001 |
| Fe+Mn | 0.031 | 0.005 | 0.011 | 0.018 | 0.014 | 0.012 | 0.004 | 0.000 | 0.015 | 0.016 | 0.001 | 0.001 | 0.002 | 0.034 | 0.000 |
| Comments: | core | rim | core | rim | | | | EB - ED same grain | | | EF & EG | | EI & EJ | | |
| | | | | | | | | colourless | brown | | same grain | | same grain | | |
| | | | | | | | | | | | colourless | dark | both colourless | | |
| | | | | | | | | | | | | brown | | | |

| | Great White North pegmatite | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-GWN2 | | | | | | | | | | | | | | | |
| | KJ | KK | HA | HB | HC | HD | HE | HF | HG | HH | HI | HJ | HK | HQ | HR | HS |
| SnO2 | 99.53 | 98.97 | 96.48 | 95.65 | 99.02 | 99.80 | 94.65 | 92.73 | 93.11 | 100.23 | 99.66 | 93.60 | 93.00 | 98.13 | 94.63 | 97.10 |
| FeO | 0.05 | 0.07 | 0.03 | 0.05 | 0.02 | 0.05 | 0.03 | 0.09 | 0.14 | 0.03 | 0.06 | 0.07 | 0.08 | 0.28 | 0.64 | 0.16 |
| MnO | 0.02 | 0.02 | 0.29 | 0.37 | 0.10 | 0.05 | 0.54 | 0.84 | 0.74 | 0.01 | 0.03 | 0.69 | 0.72 | 0.07 | 0.33 | 0.21 |
| Nb2O5 | 0.00 | 0.03 | 1.32 | 1.09 | 1.02 | 0.04 | 1.27 | 0.90 | 0.95 | 0.08 | 0.08 | 1.77 | 1.70 | 0.89 | 1.66 | 0.62 |
| Ta2O5 | 0.41 | 0.77 | 1.78 | 2.70 | 0.66 | 0.91 | 3.65 | 5.93 | 5.38 | 0.23 | 0.77 | 3.91 | 4.70 | 1.05 | 3.34 | 2.15 |
| Total | 100.01 | 99.86 | 99.91 | 99.86 | 100.82 | 100.84 | 100.14 | 100.49 | 100.31 | 100.58 | 100.60 | 100.04 | 100.20 | 100.42 | 100.59 | 100.24 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.992 | 1.984 | 1.925 | 1.914 | 1.958 | 1.982 | 1.890 | 1.854 | 1.863 | 1.993 | 1.983 | 1.867 | 1.855 | 1.950 | 1.877 | 1.938 |
| Fe | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.002 | 0.001 | 0.004 | 0.006 | 0.001 | 0.002 | 0.003 | 0.003 | 0.012 | 0.027 | 0.007 |
| Mn | 0.001 | 0.001 | 0.012 | 0.016 | 0.004 | 0.002 | 0.023 | 0.036 | 0.032 | 0.001 | 0.001 | 0.029 | 0.031 | 0.003 | 0.014 | 0.009 |
| Nb | 0.000 | 0.001 | 0.030 | 0.025 | 0.023 | 0.001 | 0.029 | 0.020 | 0.022 | 0.002 | 0.002 | 0.040 | 0.039 | 0.020 | 0.037 | 0.014 |
| Ta | 0.006 | 0.011 | 0.024 | 0.037 | 0.009 | 0.012 | 0.050 | 0.081 | 0.073 | 0.003 | 0.010 | 0.053 | 0.064 | 0.014 | 0.045 | 0.029 |
| Total | 2.000 | 1.999 | 1.993 | 1.993 | 1.994 | 1.999 | 1.992 | 1.994 | 1.995 | 2.000 | 1.999 | 1.993 | 1.991 | 1.999 | 2.000 | 1.997 |
| Sn end | 99.578 | 99.250 | 96.602 | 96.019 | 98.159 | 99.141 | 94.849 | 92.949 | 93.376 | 99.671 | 99.195 | 93.699 | 93.158 | 97.549 | 93.862 | 97.058 |
| FeMn end | 0.145 | 0.188 | 0.678 | 0.888 | 0.246 | 0.201 | 1.213 | 1.978 | 1.867 | 0.082 | 0.193 | 1.616 | 1.696 | 0.740 | 2.016 | 0.775 |
| NbTa end | 0.276 | 0.563 | 2.720 | 3.094 | 1.595 | 0.658 | 3.938 | 5.073 | 4.757 | 0.247 | 0.612 | 4.684 | 5.146 | 1.711 | 4.121 | 2.167 |
| Nb+Ta | 0.006 | 0.011 | 0.054 | 0.062 | 0.032 | 0.013 | 0.078 | 0.101 | 0.095 | 0.005 | 0.012 | 0.093 | 0.102 | 0.034 | 0.082 | 0.043 |
| Fe+Mn | 0.003 | 0.004 | 0.014 | 0.018 | 0.005 | 0.004 | 0.024 | 0.039 | 0.037 | 0.002 | 0.004 | 0.032 | 0.034 | 0.015 | 0.040 | 0.015 |
| Comments: | KJ & KK | | HA & HB | | HC & HD | | HE & HF | | | | HI - HK | | | | | |
| | same grain | | same grain | | same | | same grain | | | | same grain | | | | | |
| | | | brown | brown | grain | colourless | | | colourless | | colourless | | dark brown | | | |
| | | | | | brown | | brown | brown | | colourless | | dark brown | | | | |
| | | | | | | | | | some cassiterite in this sample is strongly zoned | | | | | | | |

| | Great White North pegmatite | | | |
|---|---|---|---|---|
| | 97-GWN3 | | | |
| | FG | FK | FL | FM |
| SnO2 | 99.40 | 100.21 | 100.13 | 100.02 |
| FeO | 0.18 | 0.00 | 0.01 | 0.04 |
| MnO | 0.01 | 0.01 | 0.02 | 0.04 |
| Nb2O5 | 0.21 | 0.01 | 0.04 | 0.29 |
| Ta2O5 | 0.96 | 0.07 | 0.27 | 0.39 |
| Total | 100.76 | 100.30 | 100.45 | 100.77 |
| | **Structural formulae based on 4 oxy** | | | |
| Sn | 1.974 | 1.998 | 1.994 | 1.984 |
| Fe | 0.007 | 0.000 | 0.000 | 0.002 |
| Mn | 0.001 | 0.001 | 0.001 | 0.002 |
| Nb | 0.005 | 0.000 | 0.001 | 0.006 |
| Ta | 0.013 | 0.001 | 0.004 | 0.005 |
| Total | 2.000 | 2.000 | 1.999 | 1.999 |
| Sn end | 98.717 | 99.913 | 99.728 | 99.256 |
| FeMn end | 0.400 | 0.025 | 0.046 | 0.153 |
| NbTa end | 0.883 | 0.062 | 0.225 | 0.591 |
| Nb+Ta | 0.018 | 0.001 | 0.005 | 0.012 |
| Fe+Mn | 0.008 | 0.001 | 0.001 | 0.003 |
| Comments: | dark brown | dark brown<br>some grains<br>contain tiny inclusions | colourless | |

## Cassiterite

| | **Gt. White Nth.** | | **Great White North** | | | | | **Great White North** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 97-GWN3 | | 97-GWN4 | | | | | 97-GWN5 | | |
| | FN | FO | RA | RB | RC | RF | RG | KO | KP | KQ |
| SnO2 | 99.01 | 100.60 | 97.82 | 96.89 | 98.92 | 97.53 | 98.42 | 95.61 | 95.95 | 96.35 |
| FeO | 0.07 | 0.01 | 0.35 | 0.43 | 0.23 | 0.45 | 0.37 | 0.39 | 0.37 | 0.31 |
| MnO | 0.09 | 0.00 | 0.06 | 0.12 | 0.03 | 0.08 | 0.06 | 0.18 | 0.12 | 0.10 |
| Nb2O5 | 0.41 | 0.04 | 1.03 | 1.00 | 0.23 | 1.10 | 0.92 | 1.49 | 1.38 | 0.97 |
| Ta2O5 | 0.77 | 0.24 | 0.79 | 1.44 | 0.92 | 0.98 | 0.75 | 1.81 | 1.65 | 1.94 |
| | | | | | | | | | | |
| Total | 100.34 | 100.89 | 100.05 | 99.87 | 100.33 | 100.13 | 100.52 | 99.47 | 99.47 | 99.68 |
| | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.972 | 1.995 | 1.949 | 1.936 | 1.972 | 1.941 | 1.952 | 1.915 | 1.922 | 1.931 |
| Fe | 0.003 | 0.000 | 0.015 | 0.018 | 0.010 | 0.019 | 0.016 | 0.016 | 0.016 | 0.013 |
| Mn | 0.004 | 0.000 | 0.003 | 0.005 | 0.001 | 0.003 | 0.002 | 0.007 | 0.005 | 0.004 |
| Nb | 0.009 | 0.001 | 0.023 | 0.023 | 0.005 | 0.025 | 0.021 | 0.034 | 0.031 | 0.022 |
| Ta | 0.010 | 0.003 | 0.011 | 0.020 | 0.012 | 0.013 | 0.010 | 0.025 | 0.023 | 0.027 |
| | | | | | | | | | | |
| Total | 1.998 | 1.999 | 2.000 | 2.001 | 2.001 | 2.002 | 2.001 | 1.997 | 1.997 | 1.997 |
| | | | | | | | | | | |
| Sn end | 98.680 | 99.768 | 97.442 | 96.735 | 98.565 | 96.994 | 97.559 | 95.883 | 96.264 | 96.698 |
| FeMn end | 0.339 | 0.025 | 0.867 | 1.157 | 0.553 | 1.104 | 0.900 | 1.187 | 1.039 | 0.868 |
| NbTa end | 0.981 | 0.207 | 1.692 | 2.108 | 0.882 | 1.902 | 1.541 | 2.930 | 2.697 | 2.434 |
| | | | | | | | | | | |
| Nb+Ta | 0.020 | 0.004 | 0.034 | 0.042 | 0.018 | 0.038 | 0.031 | 0.059 | 0.054 | 0.049 |
| Fe+Mn | 0.007 | 0.000 | 0.017 | 0.023 | 0.011 | 0.022 | 0.018 | 0.024 | 0.021 | 0.017 |
| | | | | | | | | | | |
| Comments: | brown | colourless | brown | RA - RC<br>same grain | | RF & RG<br>same grain | | | KO - KQ<br>same grain<br>many tiny<br>wodginite inclusions | |

**Great White North pegmatite**

97-GWN6

| | MA | MB | MF | MG | MH | MI | MJ | MK | ML | MM | MQ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.22 | 96.42 | 95.30 | 95.73 | 99.43 | 99.32 | 97.76 | 94.83 | 97.37 | 97.23 | 98.33 |
| FeO | 0.01 | 0.15 | 0.17 | 0.29 | 0.06 | 0.02 | 0.09 | 0.42 | 0.33 | 0.07 | 0.14 |
| MnO | 0.01 | 0.16 | 0.32 | 0.18 | 0.00 | 0.02 | 0.06 | 0.18 | 0.02 | 0.09 | 0.01 |
| Nb2O5 | 0.05 | 0.68 | 1.11 | 1.19 | 0.03 | 0.06 | 0.07 | 1.26 | 0.78 | 0.60 | 0.07 |
| Ta2O5 | 0.16 | 1.49 | 2.17 | 1.30 | 0.37 | 0.42 | 1.21 | 2.30 | 0.72 | 0.92 | 0.82 |
| Total | 99.45 | 98.89 | 99.07 | 98.69 | 99.89 | 99.82 | 99.18 | 98.99 | 99.22 | 98.90 | 99.37 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.995 | 1.948 | 1.921 | 1.934 | 1.992 | 1.991 | 1.974 | 1.912 | 1.958 | 1.964 | 1.981 |
| Fe | 0.000 | 0.006 | 0.007 | 0.012 | 0.003 | 0.001 | 0.004 | 0.018 | 0.014 | 0.003 | 0.006 |
| Mn | 0.000 | 0.007 | 0.014 | 0.008 | 0.000 | 0.001 | 0.003 | 0.008 | 0.001 | 0.004 | 0.001 |
| Nb | 0.001 | 0.015 | 0.025 | 0.027 | 0.001 | 0.001 | 0.002 | 0.029 | 0.018 | 0.014 | 0.002 |
| Ta | 0.002 | 0.021 | 0.030 | 0.018 | 0.005 | 0.006 | 0.017 | 0.032 | 0.010 | 0.013 | 0.011 |
| Total | 2.000 | 1.998 | 1.921 | 1.999 | 1.992 | 1.999 | 1.999 | 1.998 | 2.000 | 1.997 | 2.000 |
| Sn end | 99.796 | 97.533 | 96.191 | 96.746 | 99.583 | 99.586 | 98.770 | 95.710 | 97.885 | 98.345 | 99.027 |
| FeMn end | 0.040 | 0.666 | 1.046 | 0.995 | 0.128 | 0.063 | 0.324 | 1.273 | 0.732 | 0.335 | 0.330 |
| NbTa end | 0.164 | 1.801 | 2.763 | 2.259 | 0.289 | 0.351 | 0.907 | 3.017 | 1.383 | 1.319 | 0.643 |
| Nb+Ta | 0.003 | 0.036 | 0.055 | 0.045 | 0.006 | 0.007 | 0.018 | 0.060 | 0.028 | 0.026 | 0.013 |
| Fe+Mn | 0.001 | 0.013 | 0.021 | 0.020 | 0.003 | 0.001 | 0.006 | 0.025 | 0.015 | 0.007 | 0.007 |
| Comments: | MA & MB | | | | | | MJ & MK | | ML & MM | | |
| | same grain | | | | | | same grain | | same grain | | |
| | colourless | | | | | | colourless | | light | | brown |
| | | brown | | | | | | brown | brown | dark brown | |

|  |  |  | Pegmatite 7 |  |  |  |  |  |  |  |  | Pegmatite 10 |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | 97-P7-1 |  |  |  |  |  |  |  |  | 97-P10-1 |  |  |  |  |  |  |
|  | SA | SB | SC | SJ | SS | SW | VH | VI | VJ | VK | VL | VM | VN | VO | VP | VT | VU | VV |
| SnO2 | 95.57 | 91.28 | 94.42 | 99.22 | 98.10 | 93.02 | 99.76 | 98.06 | 98.50 | 97.53 | 97.55 | 98.20 | 97.80 | 97.88 | 99.13 | 97.04 | 97.54 | 97.94 |
| FeO | 0.70 | 1.31 | 0.82 | 0.13 | 0.30 | 1.10 | 0.04 | 0.30 | 0.25 | 0.36 | 0.37 | 0.27 | 0.32 | 0.39 | 0.16 | 0.41 | 0.32 | 0.30 |
| MnO | 0.02 | 0.06 | 0.03 | 0.01 | 0.00 | 0.05 | 0.00 | 0.00 | 0.02 | 0.03 | 0.03 | 0.01 | 0.01 | 0.02 | 0.00 | 0.03 | 0.00 | 0.02 |
| Nb2O5 | 0.30 | 0.80 | 0.33 | 0.05 | 0.11 | 0.62 | 0.03 | 0.13 | 0.11 | 0.15 | 0.25 | 0.14 | 0.09 | 0.33 | 0.12 | 0.17 | 0.12 | 0.11 |
| Ta2O5 | 3.60 | 6.64 | 4.15 | 0.87 | 1.48 | 5.42 | 0.41 | 1.29 | 1.26 | 2.39 | 2.15 | 1.51 | 1.68 | 1.79 | 0.94 | 1.94 | 1.72 | 1.45 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | 100.17 | 100.09 | 99.75 | 100.28 | 99.99 | 100.21 | 100.24 | 99.77 | 100.13 | 100.45 | 100.36 | 100.13 | 99.91 | 100.41 | 100.35 | 99.59 | 99.70 | 99.81 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **Structural formulae based on 4 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sn | 1.915 | 1.834 | 1.901 | 1.981 | 1.965 | 1.865 | 1.991 | 1.968 | 1.970 | 1.947 | 1.948 | 1.964 | 1.962 | 1.952 | 1.977 | 1.953 | 1.960 | 1.965 |
| Fe | 0.029 | 0.055 | 0.035 | 0.005 | 0.012 | 0.046 | 0.002 | 0.013 | 0.010 | 0.015 | 0.016 | 0.011 | 0.014 | 0.016 | 0.007 | 0.017 | 0.014 | 0.012 |
| Mn | 0.001 | 0.003 | 0.001 | 0.000 | 0.000 | 0.002 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Nb | 0.007 | 0.018 | 0.007 | 0.001 | 0.002 | 0.014 | 0.001 | 0.003 | 0.002 | 0.003 | 0.006 | 0.003 | 0.002 | 0.008 | 0.003 | 0.004 | 0.003 | 0.003 |
| Ta | 0.049 | 0.091 | 0.057 | 0.012 | 0.020 | 0.074 | 0.006 | 0.018 | 0.017 | 0.033 | 0.029 | 0.021 | 0.023 | 0.024 | 0.013 | 0.027 | 0.024 | 0.020 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Total | 2.001 | 2.002 | 2.002 | 2.000 | 2.001 | 2.002 | 1.999 | 2.001 | 2.001 | 1.999 | 2.000 | 2.000 | 2.001 | 2.001 | 2.000 | 2.002 | 2.000 | 2.001 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Sn end | 95.702 | 91.646 | 94.979 | 99.059 | 98.236 | 93.162 | 99.595 | 98.346 | 98.463 | 97.396 | 97.404 | 98.229 | 98.045 | 97.547 | 98.882 | 97.545 | 98.005 | 98.223 |
| FeMn end | 1.506 | 2.899 | 1.802 | 0.291 | 0.628 | 2.428 | 0.101 | 0.625 | 0.554 | 0.811 | 0.849 | 0.579 | 0.705 | 0.860 | 0.343 | 0.930 | 0.676 | 0.657 |
| NbTa end | 2.791 | 5.455 | 3.219 | 0.649 | 1.136 | 4.410 | 0.304 | 1.029 | 0.983 | 1.792 | 1.746 | 1.192 | 1.250 | 1.594 | 0.775 | 1.525 | 1.319 | 1.121 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Nb+Ta | 0.056 | 0.109 | 0.064 | 0.013 | 0.023 | 0.088 | 0.006 | 0.021 | 0.020 | 0.036 | 0.035 | 0.024 | 0.025 | 0.032 | 0.016 | 0.031 | 0.026 | 0.022 |
| Fe+Mn | 0.030 | 0.058 | 0.036 | 0.006 | 0.013 | 0.049 | 0.002 | 0.013 | 0.011 | 0.016 | 0.017 | 0.012 | 0.014 | 0.017 | 0.007 | 0.019 | 0.014 | 0.013 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Comments: |  | SA - SC<br>same grain |  |  | close association<br>with ferrowodginite |  | pale brown |  | VH - VL<br>same large grain<br>colourless |  | pale brown | VM & VN<br>same grain |  | VO & VP<br>same grain |  | · | VU & VV<br>same grain<br>brown |  |
|  |  |  |  |  |  |  |  | brown |  | colourless |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  | contains inclusions of ferrowodginite, ferrotapiolite & microlite |  |  |  |  |  |  |  |  |  |

**Pegmatite 10**

97-P10-1

| | WA | WB | WL | WM | WN | WO | JA | JB | JC | JF | JD | JE | JG | JH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 98.14 | 97.88 | 95.93 | 97.86 | 95.86 | 99.05 | 99.55 | 98.54 | 99.29 | 97.46 | 91.28 | 98.97 | 93.48 | 95.83 |
| FeO | 0.19 | 0.33 | 0.52 | 0.24 | 0.39 | 0.08 | 0.06 | 0.17 | 0.05 | 0.25 | 0.44 | 0.09 | 0.75 | 0.58 |
| MnO | 0.00 | 0.01 | 0.03 | 0.00 | 0.14 | 0.01 | 0.00 | 0.02 | 0.01 | 0.02 | 0.67 | 0.03 | 0.10 | 0.01 |
| Nb2O5 | 0.17 | 0.21 | 0.63 | 0.17 | 0.25 | 0.02 | 0.02 | 0.13 | 0.02 | 0.10 | 0.46 | 0.09 | 0.31 | 0.17 |
| Ta2O5 | 1.04 | 1.52 | 2.38 | 1.15 | 3.44 | 0.55 | 0.44 | 0.94 | 0.43 | 1.89 | 7.26 | 1.05 | 5.33 | 2.98 |
| Total | 99.54 | 99.94 | 99.49 | 99.43 | 100.07 | 99.71 | 100.06 | 99.80 | 99.79 | 99.72 | 100.10 | 100.23 | 99.97 | 99.57 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Sn | 1.973 | 1.961 | 1.930 | 1.970 | 1.923 | 1.988 | 1.991 | 1.976 | 1.991 | 1.959 | 1.839 | 1.977 | 1.882 | 1.932 |
| Fe | 0.008 | 0.014 | 0.022 | 0.010 | 0.016 | 0.004 | 0.002 | 0.007 | 0.002 | 0.010 | 0.018 | 0.004 | 0.032 | 0.024 |
| Mn | 0.000 | 0.000 | 0.001 | 0.000 | 0.006 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.029 | 0.001 | 0.004 | 0.000 |
| Nb | 0.004 | 0.005 | 0.014 | 0.004 | 0.006 | 0.001 | 0.000 | 0.003 | 0.000 | 0.002 | 0.011 | 0.002 | 0.007 | 0.004 |
| Ta | 0.014 | 0.021 | 0.033 | 0.016 | 0.047 | 0.007 | 0.006 | 0.013 | 0.006 | 0.026 | 0.100 | 0.014 | 0.073 | 0.041 |
| Total | 2.000 | 2.001 | 2.000 | 2.000 | 1.998 | 2.000 | 2.000 | 2.000 | 2.000 | 1.999 | 1.996 | 1.999 | 1.998 | 2.001 |
| Sn end | 98.697 | 98.024 | 96.500 | 98.504 | 96.254 | 99.404 | 99.558 | 98.810 | 99.567 | 98.019 | 92.113 | 98.917 | 94.186 | 96.516 |
| FeMn end | 0.403 | 0.704 | 1.148 | 0.511 | 1.107 | 0.196 | 0.120 | 0.400 | 0.124 | 0.570 | 2.363 | 0.263 | 1.801 | 1.244 |
| NbTa end | 0.901 | 1.272 | 2.352 | 0.986 | 2.639 | 0.400 | 0.322 | 0.790 | 0.308 | 1.411 | 5.523 | 0.820 | 4.013 | 2.239 |
| Nb+Ta | 0.018 | 0.025 | 0.047 | 0.020 | 0.053 | 0.008 | 0.006 | 0.016 | 0.006 | 0.028 | 0.110 | 0.016 | 0.080 | 0.045 |
| Fe+Mn | 0.008 | 0.014 | 0.023 | 0.010 | 0.022 | 0.004 | 0.002 | 0.008 | 0.002 | 0.011 | 0.047 | 0.005 | 0.036 | 0.025 |
| Comments: | WA & WB<br>same grain<br>brown | | WL & WM<br>same grain | | | | | | JC & JF<br>same grain | | JD & JE<br>same grain | | JG & JH<br>same grain | |

sample contains many grains of cassiterite & columbite

**Pegmatite 10**

97-P10-1

| | JI | JL | JM | JQ | JR | JS | JT | JW | JX | JY | JZ | KF | KG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 93.64 | 98.63 | 88.06 | 98.66 | 99.44 | 99.62 | 97.31 | 98.26 | 97.31 | 98.78 | 97.17 | 98.94 | 97.46 |
| FeO | 0.32 | 0.09 | 0.50 | 0.21 | 0.09 | 0.08 | 0.42 | 0.26 | 0.28 | 0.22 | 0.49 | 0.17 | 0.08 |
| MnO | 0.44 | 0.04 | 1.04 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.09 | 0.01 | 0.01 | 0.00 | 0.10 |
| Nb2O5 | 0.35 | 0.05 | 0.91 | 0.07 | 0.04 | 0.04 | 0.28 | 0.14 | 0.12 | 0.18 | 0.18 | 0.03 | 0.70 |
| Ta2O5 | 5.13 | 1.15 | 9.71 | 1.07 | 0.40 | 0.50 | 2.13 | 1.27 | 2.28 | 1.12 | 2.64 | 0.96 | 1.34 |
| Total | 99.88 | 99.95 | 100.22 | 100.02 | 99.98 | 100.24 | 100.13 | 99.93 | 100.08 | 100.30 | 100.49 | 100.10 | 99.68 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.886 | 1.976 | 1.774 | 1.975 | 1.990 | 1.989 | 1.947 | 1.969 | 1.950 | 1.971 | 1.940 | 1.979 | 1.953 |
| Fe | 0.014 | 0.004 | 0.021 | 0.009 | 0.004 | 0.003 | 0.018 | 0.011 | 0.012 | 0.009 | 0.020 | 0.007 | 0.003 |
| Mn | 0.019 | 0.002 | 0.044 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.004 | 0.000 | 0.001 | 0.000 | 0.004 |
| Nb | 0.008 | 0.001 | 0.021 | 0.002 | 0.001 | 0.001 | 0.006 | 0.003 | 0.003 | 0.004 | 0.004 | 0.001 | 0.016 |
| Ta | 0.070 | 0.016 | 0.133 | 0.015 | 0.005 | 0.007 | 0.029 | 0.017 | 0.031 | 0.015 | 0.036 | 0.013 | 0.018 |
| Total | 1.997 | 1.998 | 1.994 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 1.999 | 2.000 | 2.000 | 2.000 | 1.995 |
| Sn end | 94.444 | 98.888 | 88.973 | 98.736 | 99.481 | 99.443 | 97.349 | 98.423 | 97.536 | 98.558 | 96.960 | 98.956 | 97.909 |
| FeMn end | 1.626 | 0.268 | 3.287 | 0.447 | 0.195 | 0.174 | 0.888 | 0.553 | 0.774 | 0.477 | 1.045 | 0.357 | 0.378 |
| NbTa end | 3.930 | 0.844 | 7.740 | 0.817 | 0.324 | 0.383 | 1.763 | 1.025 | 1.690 | 0.964 | 1.995 | 0.687 | 1.714 |
| Nb+Ta | 0.078 | 0.017 | 0.154 | 0.016 | 0.006 | 0.008 | 0.035 | 0.020 | 0.034 | 0.019 | 0.040 | 0.014 | 0.034 |
| Fe+Mn | 0.032 | 0.005 | 0.066 | 0.009 | 0.004 | 0.003 | 0.018 | 0.011 | 0.015 | 0.010 | 0.021 | 0.007 | 0.008 |
| Comments: | | JL & JM<br>same grain | | | | | | JW & JX<br>same grain | | JY & JZ<br>same grain | | KF & KG<br>same grain | |

sample contains many grains of cassiterite & columbite

**Pegmatite 10**

97-P10-1

| | TA | TB | TC | TD | TE | TF | TG | TH | TI | TJ | TK | TL | TM |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 91.16 | 90.23 | 95.13 | 89.18 | 92.91 | 96.72 | 98.04 | 97.43 | 96.70 | 98.42 | 90.61 | 91.54 | 92.37 |
| FeO | 0.46 | 0.47 | 0.43 | 0.53 | 0.61 | 0.27 | 0.13 | 0.12 | 0.42 | 0.20 | 0.42 | 0.39 | 0.35 |
| MnO | 0.62 | 0.72 | 0.18 | 0.81 | 0.28 | 0.13 | 0.04 | 0.13 | 0.02 | 0.00 | 0.70 | 0.64 | 0.53 |
| Nb2O5 | 0.50 | 0.46 | 0.51 | 0.63 | 0.41 | 0.19 | 0.10 | 0.10 | 0.14 | 0.05 | 0.54 | 0.39 | 0.45 |
| Ta2O5 | 6.85 | 7.84 | 3.48 | 8.53 | 5.61 | 2.52 | 1.21 | 2.22 | 2.42 | 1.15 | 7.43 | 6.73 | 6.08 |
| Total | 99.60 | 99.72 | 99.73 | 99.68 | 99.82 | 99.83 | 99.51 | 100.01 | 99.70 | 99.81 | 99.70 | 99.69 | 99.78 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.844 | 1.826 | 1.913 | 1.806 | 1.873 | 1.943 | 1.973 | 1.954 | 1.945 | 1.975 | 1.833 | 1.851 | 1.864 |
| Fe | 0.020 | 0.020 | 0.018 | 0.022 | 0.026 | 0.011 | 0.005 | 0.005 | 0.018 | 0.009 | 0.018 | 0.016 | 0.015 |
| Mn | 0.026 | 0.031 | 0.008 | 0.035 | 0.012 | 0.006 | 0.002 | 0.006 | 0.001 | 0.000 | 0.030 | 0.028 | 0.023 |
| Nb | 0.011 | 0.011 | 0.012 | 0.014 | 0.009 | 0.004 | 0.002 | 0.002 | 0.003 | 0.001 | 0.012 | 0.009 | 0.010 |
| Ta | 0.095 | 0.108 | 0.048 | 0.118 | 0.077 | 0.035 | 0.017 | 0.030 | 0.033 | 0.016 | 0.102 | 0.093 | 0.084 |
| Total | 1.997 | 1.996 | 1.998 | 1.996 | 1.997 | 1.999 | 1.999 | 1.997 | 2.000 | 2.000 | 1.995 | 1.997 | 1.995 |
| Sn end | 92.381 | 91.512 | 95.741 | 90.504 | 93.780 | 97.211 | 98.702 | 97.826 | 97.260 | 98.736 | 91.838 | 92.700 | 93.418 |
| FeMn end | 2.308 | 2.534 | 1.286 | 2.870 | 1.885 | 0.847 | 0.360 | 0.538 | 0.926 | 0.427 | 2.413 | 2.205 | 1.866 |
| NbTa end | 5.311 | 5.955 | 2.973 | 6.626 | 4.335 | 1.942 | 0.938 | 1.635 | 1.813 | 0.836 | 5.750 | 5.095 | 4.716 |
| Nb+Ta | 0.106 | 0.119 | 0.059 | 0.132 | 0.087 | 0.039 | 0.019 | 0.033 | 0.036 | 0.017 | 0.115 | 0.102 | 0.094 |
| Fe+Mn | 0.046 | 0.051 | 0.026 | 0.057 | 0.038 | 0.017 | 0.007 | 0.011 | 0.019 | 0.009 | 0.048 | 0.044 | 0.037 |
| Comments: | | | | TA - TG<br>same grain as JD & JE | | | | TH - TM<br>same grain as JG & JH<br>deep<br>red | | | | black | |

sample contains many grains of cassiterite & columbite

**Pegmatite 10**

97-P10-1

| | TN | TO | TP | TQ | TR | TS | TT | TU | TV | TW | TX | TY |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 96.95 | 97.24 | 97.53 | 88.10 | 98.09 | 96.85 | 97.36 | 98.68 | 86.82 | 93.85 | 87.22 | 98.98 |
| FeO | 0.26 | 0.36 | 0.32 | 0.48 | 0.16 | 0.36 | 0.41 | 0.07 | 0.52 | 0.88 | 0.53 | 0.07 |
| MnO | 0.05 | 0.02 | 0.00 | 0.99 | 0.06 | 0.06 | 0.00 | 0.03 | 1.07 | 0.01 | 1.06 | 0.01 |
| Nb2O5 | 0.14 | 0.07 | 0.22 | 0.79 | 0.09 | 0.11 | 0.16 | 0.08 | 0.82 | 0.55 | 0.76 | 0.00 |
| Ta2O5 | 2.21 | 2.06 | 1.75 | 9.43 | 1.51 | 2.27 | 1.89 | 0.96 | 10.34 | 4.32 | 10.08 | 0.35 |
| Total | 99.62 | 99.75 | 99.81 | 99.78 | 99.91 | 99.64 | 99.81 | 99.81 | 99.57 | 99.61 | 99.64 | 99.41 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | |
| Sn | 1.951 | 1.955 | 1.957 | 1.783 | 1.967 | 1.949 | 1.955 | 1.979 | 1.763 | 1.891 | 1.770 | 1.992 |
| Fe | 0.011 | 0.015 | 0.013 | 0.020 | 0.007 | 0.015 | 0.017 | 0.003 | 0.022 | 0.037 | 0.023 | 0.003 |
| Mn | 0.002 | 0.001 | 0.000 | 0.042 | 0.002 | 0.003 | 0.000 | 0.001 | 0.046 | 0.000 | 0.046 | 0.000 |
| Nb | 0.003 | 0.002 | 0.005 | 0.018 | 0.002 | 0.003 | 0.004 | 0.002 | 0.019 | 0.013 | 0.017 | 0.000 |
| Ta | 0.030 | 0.028 | 0.024 | 0.130 | 0.021 | 0.031 | 0.026 | 0.013 | 0.143 | 0.059 | 0.140 | 0.005 |
| Total | 1.998 | 2.001 | 2.000 | 1.994 | 1.999 | 2.000 | 2.001 | 1.998 | 1.993 | 2.001 | 1.995 | 2.001 |
| Sn end | 97.650 | 97.705 | 97.886 | 89.424 | 98.406 | 97.439 | 97.665 | 99.049 | 88.450 | 94.532 | 88.714 | 99.584 |
| FeMn end | 0.671 | 0.799 | 0.674 | 3.137 | 0.460 | 0.877 | 0.865 | 0.205 | 3.412 | 1.872 | 3.421 | 0.175 |
| NbTa end | 1.679 | 1.495 | 1.440 | 7.439 | 1.133 | 1.684 | 1.471 | 0.746 | 8.138 | 3.596 | 7.865 | 0.240 |
| Nb+Ta | 0.034 | 0.030 | 0.029 | 0.148 | 0.023 | 0.034 | 0.029 | 0.015 | 0.162 | 0.072 | 0.157 | 0.005 |
| Fe+Mn | 0.013 | 0.016 | 0.013 | 0.063 | 0.009 | 0.018 | 0.017 | 0.004 | 0.068 | 0.037 | 0.068 | 0.004 |
| Comments: | | TN - TF<br>same grain | | | | | | TQ - TY same grain as JL & JM<br>discrete Ta-poor & Ta-rich parts to this grain | | | | |
| | deep red | | | | pale brown | | | | | | | red |

sample contains many grains of cassiterite & columbite

**Pegmatite 10**

97-P10-2

| | LC | LD | LG | LI | LJ | LK | LO | LR | LS | LW |
|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 96.88 | 96.28 | 96.37 | 95.98 | 98.39 | 99.27 | 95.86 | 97.04 | 97.05 | 95.70 |
| FeO | 0.45 | 0.35 | 0.52 | 0.42 | 0.24 | 0.12 | 0.47 | 0.23 | 0.25 | 0.39 |
| MnO | 0.00 | 0.13 | 0.03 | 0.06 | 0.01 | 0.01 | 0.08 | 0.12 | 0.12 | 0.13 |
| Nb2O5 | 0.17 | 0.13 | 0.20 | 0.12 | 0.19 | 0.00 | 0.28 | 0.19 | 0.17 | 0.21 |
| Ta2O5 | 2.49 | 3.18 | 3.32 | 3.40 | 1.33 | 0.70 | 3.20 | 2.54 | 2.44 | 3.26 |
| Total | 99.99 | 100.08 | 100.45 | 99.98 | 100.15 | 100.10 | 99.89 | 100.12 | 100.02 | 99.69 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.943 | 1.932 | 1.926 | 1.928 | 1.967 | 1.985 | 1.926 | 1.944 | 1.946 | 1.927 |
| Fe | 0.019 | 0.015 | 0.022 | 0.018 | 0.010 | 0.005 | 0.020 | 0.010 | 0.010 | 0.016 |
| Mn | 0.000 | 0.006 | 0.001 | 0.003 | 0.000 | 0.000 | 0.003 | 0.005 | 0.005 | 0.006 |
| Nb | 0.004 | 0.003 | 0.005 | 0.003 | 0.004 | 0.000 | 0.006 | 0.004 | 0.004 | 0.005 |
| Ta | 0.034 | 0.044 | 0.045 | 0.047 | 0.018 | 0.010 | 0.044 | 0.035 | 0.033 | 0.045 |
| Total | 2.000 | 1.999 | 1.999 | 1.998 | 2.000 | 2.000 | 1.999 | 1.998 | 1.998 | 1.999 |
| Sn end | 97.152 | 96.652 | 96.341 | 96.513 | 98.372 | 99.250 | 96.333 | 97.300 | 97.369 | 96.418 |
| FeMn end | 0.951 | 1.025 | 1.171 | 1.022 | 0.510 | 0.271 | 1.153 | 0.752 | 0.769 | 1.102 |
| NbTa end | 1.897 | 2.323 | 2.488 | 2.465 | 1.119 | 0.479 | 2.514 | 1.948 | 1.862 | 2.479 |
| Nb+Ta | 0.038 | 0.046 | 0.050 | 0.049 | 0.022 | 0.010 | 0.050 | 0.039 | 0.037 | 0.050 |
| Fe+Mn | 0.019 | 0.020 | 0.023 | 0.020 | 0.010 | 0.005 | 0.023 | 0.015 | 0.015 | 0.022 |
| Comments: | | | | LI & LJ<br>same grain | | | | | | |

## Cassiterite

| | | | **Pegmatite 10** | | | | | | | | | **Pegmatite 10** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 97-P10-3 | | | | | | | | | 97-P10-4 | | | | | | |
| | NA | NB | NC | NF | NJ | NK | MC | MD | MG | MH | MI | MJ | MK | ML | MO | MP | MQ | MR |
| SnO2 | 98.13 | 95.62 | 98.41 | 97.28 | 96.15 | 98.67 | 96.71 | 98.09 | 97.88 | 97.95 | 100.32 | 98.75 | 90.54 | 88.16 | 97.77 | 95.39 | 95.06 | 99.01 |
| FeO | 0.06 | 0.52 | 0.25 | 0.35 | 0.44 | 0.23 | 0.34 | 0.25 | 0.27 | 0.38 | 0.05 | 0.11 | 0.95 | 1.77 | 0.29 | 0.42 | 0.50 | 0.10 |
| MnO | 0.10 | 0.08 | 0.00 | 0.00 | 0.05 | 0.01 | 0.08 | 0.02 | 0.05 | 0.01 | 0.00 | 0.01 | 0.35 | 0.07 | 0.01 | 0.14 | 0.12 | 0.01 |
| Nb2O5 | 0.51 | 0.53 | 0.03 | 0.14 | 0.54 | 0.15 | 0.22 | 0.28 | 0.15 | 0.38 | 0.04 | 0.13 | 0.54 | 0.77 | 0.17 | 0.31 | 0.78 | 0.02 |
| Ta2O5 | 1.61 | 3.55 | 1.46 | 1.96 | 2.64 | 1.10 | 2.58 | 1.28 | 2.14 | 1.67 | 0.39 | 0.80 | 7.67 | 9.18 | 1.48 | 3.70 | 3.27 | 0.62 |
| Total | 100.41 | 100.29 | 100.15 | 99.74 | 99.82 | 100.16 | 99.93 | 99.91 | 100.49 | 100.39 | 100.80 | 99.80 | 100.04 | 99.96 | 99.71 | 99.97 | 99.73 | 99.75 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | | | |
| Sn | 1.955 | 1.912 | 1.969 | 1.955 | 1.929 | 1.972 | 1.941 | 1.965 | 1.953 | 1.953 | 1.991 | 1.980 | 1.825 | 1.781 | 1.964 | 1.916 | 1.909 | 1.987 |
| Fe | 0.002 | 0.022 | 0.011 | 0.015 | 0.018 | 0.010 | 0.014 | 0.011 | 0.011 | 0.016 | 0.002 | 0.005 | 0.040 | 0.075 | 0.012 | 0.018 | 0.021 | 0.004 |
| Mn | 0.004 | 0.004 | 0.000 | 0.000 | 0.002 | 0.000 | 0.003 | 0.001 | 0.002 | 0.001 | 0.000 | 0.001 | 0.015 | 0.003 | 0.000 | 0.006 | 0.005 | 0.000 |
| Nb | 0.011 | 0.012 | 0.001 | 0.003 | 0.012 | 0.003 | 0.005 | 0.006 | 0.003 | 0.009 | 0.001 | 0.003 | 0.012 | 0.018 | 0.004 | 0.007 | 0.018 | 0.000 |
| Ta | 0.022 | 0.048 | 0.020 | 0.027 | 0.036 | 0.015 | 0.035 | 0.017 | 0.029 | 0.023 | 0.005 | 0.011 | 0.105 | 0.126 | 0.020 | 0.051 | 0.045 | 0.008 |
| Total | 1.995 | 1.997 | 2.000 | 2.000 | 1.998 | 2.000 | 1.999 | 2.000 | 1.998 | 2.000 | 2.000 | 1.999 | 1.998 | 2.003 | 2.000 | 1.997 | 1.997 | 2.000 |
| Sn end | 97.997 | 95.722 | 98.439 | 97.751 | 96.541 | 98.589 | 97.101 | 98.244 | 97.712 | 97.605 | 99.582 | 99.058 | 91.353 | 88.901 | 98.170 | 95.915 | 95.561 | 99.326 |
| FeMn end | 0.331 | 1.258 | 0.533 | 0.746 | 1.029 | 0.491 | 0.878 | 0.566 | 0.659 | 0.828 | 0.110 | 0.253 | 2.754 | 3.900 | 0.626 | 1.189 | 1.306 | 0.230 |
| NbTa end | 1.671 | 3.021 | 1.028 | 1.503 | 2.430 | 0.920 | 2.021 | 1.191 | 1.629 | 1.567 | 0.308 | 0.689 | 5.893 | 7.199 | 1.205 | 2.896 | 3.133 | 0.445 |
| Nb+Ta | 0.033 | 0.060 | 0.021 | 0.030 | 0.049 | 0.018 | 0.040 | 0.024 | 0.033 | 0.031 | 0.006 | 0.014 | 0.118 | 0.144 | 0.024 | 0.058 | 0.063 | 0.009 |
| Fe+Mn | 0.007 | 0.025 | 0.011 | 0.015 | 0.021 | 0.010 | 0.018 | 0.011 | 0.013 | 0.017 | 0.002 | 0.005 | 0.055 | 0.078 | 0.013 | 0.024 | 0.026 | 0.005 |
| Comments: | | NA - NC<br>same grain<br>contains tiny inclusions | | | NJ & NK<br>same grain<br>contains<br>ferrowodginite<br>inclusions | | | | | | | | | | note high Ta content of many of these analyses | | MQ & MR<br>same grain | |

| | Pegmatite 10<br>97-P10-4 | | | | | | | | Pegmatite 10<br>97-P10-5 | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EA | EB | EC | ED | EE | EF | EG | EH | WA | WB | WC | WD | WE | WJ |
| SnO2 | 98.44 | 99.06 | 88.57 | 95.76 | 89.93 | 93.87 | 89.52 | 88.24 | 96.19 | 93.92 | 97.02 | 95.05 | 98.31 | 97.99 |
| FeO | 0.12 | 0.04 | 0.57 | 0.21 | 0.45 | 0.25 | 0.46 | 1.69 | 0.52 | 0.73 | 0.39 | 0.69 | 0.27 | 0.26 |
| MnO | 0.00 | 0.01 | 0.89 | 0.18 | 0.79 | 0.44 | 0.80 | 0.06 | 0.02 | 0.07 | 0.00 | 0.05 | 0.00 | 0.00 |
| Nb2O5 | 0.02 | 0.00 | 0.64 | 0.17 | 0.55 | 0.39 | 0.58 | 0.74 | 0.47 | 0.53 | 0.42 | 0.46 | 0.20 | 0.13 |
| Ta2O5 | 0.86 | 0.24 | 9.35 | 2.77 | 7.89 | 4.77 | 8.23 | 9.16 | 2.24 | 4.22 | 1.72 | 3.77 | 1.43 | 1.49 |
| Total | 99.43 | 99.36 | 100.02 | 99.08 | 99.61 | 99.71 | 99.60 | 99.89 | 99.43 | 99.47 | 99.55 | 100.02 | 100.21 | 99.86 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.982 | 1.995 | 1.789 | 1.939 | 1.821 | 1.892 | 1.814 | 1.784 | 1.937 | 1.895 | 1.950 | 1.907 | 1.964 | 1.965 |
| Fe | 0.005 | 0.002 | 0.024 | 0.009 | 0.019 | 0.011 | 0.019 | 0.072 | 0.022 | 0.031 | 0.017 | 0.029 | 0.011 | 0.011 |
| Mn | 0.000 | 0.000 | 0.038 | 0.008 | 0.034 | 0.019 | 0.035 | 0.002 | 0.001 | 0.003 | 0.000 | 0.002 | 0.000 | 0.000 |
| Nb | 0.000 | 0.000 | 0.015 | 0.004 | 0.013 | 0.009 | 0.013 | 0.017 | 0.011 | 0.012 | 0.010 | 0.010 | 0.004 | 0.003 |
| Ta | 0.012 | 0.003 | 0.129 | 0.038 | 0.109 | 0.066 | 0.114 | 0.126 | 0.031 | 0.058 | 0.024 | 0.052 | 0.019 | 0.020 |
| Total | 1.999 | 2.000 | 1.995 | 1.998 | 1.996 | 1.996 | 1.995 | 2.001 | 2.001 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 |
| Sn end | 99.142 | 99.720 | 89.684 | 97.069 | 91.245 | 94.808 | 90.924 | 89.135 | 96.807 | 94.784 | 97.515 | 95.337 | 98.240 | 98.294 |
| FeMn end | 0.248 | 0.113 | 3.126 | 0.825 | 2.659 | 1.462 | 2.709 | 3.710 | 1.125 | 1.708 | 0.833 | 1.560 | 0.564 | 0.536 |
| NbTa end | 0.610 | 0.166 | 7.190 | 2.106 | 6.096 | 3.729 | 6.367 | 7.155 | 2.068 | 3.508 | 1.652 | 3.102 | 1.197 | 1.169 |
| Nb+Ta | 0.012 | 0.003 | 0.143 | 0.042 | 0.122 | 0.074 | 0.127 | 0.143 | 0.041 | 0.070 | 0.033 | 0.062 | 0.024 | 0.023 |
| Fe+Mn | 0.005 | 0.002 | 0.062 | 0.016 | 0.053 | 0.029 | 0.054 | 0.074 | 0.023 | 0.034 | 0.017 | 0.031 | 0.011 | 0.011 |
| Comments: | EA - EG<br>same grain<br>mottled grain with ferrotapiolite exsolution<br>discrete Ta-poor & Ta-rich regions | | | | | | | | large grains containing many tiny inclusions | | | | | |
| | | | | | | | | | core | rim | core | rim | | |

**Swamp pegmatite**

97-SP1

| | NE | NF | NJ | NK | JE | JF | JL | JP | JS | AA | AB | AK | AV | AW |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 98.85 | 98.57 | 98.54 | 99.03 | 100.71 | 97.19 | 93.43 | 97.32 | 99.57 | 100.03 | 99.92 | 100.27 | 99.91 | 99.90 |
| FeO | 0.01 | 0.05 | 0.09 | 0.01 | 0.00 | 0.31 | 0.50 | 0.42 | 0.05 | 0.01 | 0.02 | 0.03 | 0.04 | 0.01 |
| MnO | 0.00 | 0.04 | 0.05 | 0.02 | 0.00 | 0.12 | 0.45 | 0.05 | 0.05 | 0.02 | 0.02 | 0.00 | 0.00 | 0.00 |
| Nb2O5 | 0.01 | 0.04 | 0.20 | 0.03 | 0.05 | 0.55 | 0.64 | 0.91 | 0.13 | 0.03 | 0.02 | 0.10 | 0.01 | 0.00 |
| Ta2O5 | 0.27 | 0.75 | 0.42 | 0.51 | 0.19 | 1.82 | 4.96 | 1.24 | 1.00 | 0.26 | 0.46 | 0.31 | 0.37 | 0.31 |
| | | | | | | | | | | | | | | |
| Total | 99.13 | 99.44 | 99.29 | 99.60 | 100.95 | 99.97 | 99.97 | 99.94 | 100.80 | 100.34 | 100.43 | 100.71 | 100.32 | 100.21 |
| | | | | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.995 | 1.984 | 1.984 | 1.990 | 1.995 | 1.945 | 1.877 | 1.943 | 1.977 | 1.994 | 1.991 | 1.991 | 1.993 | 1.995 |
| Fe | 0.000 | 0.002 | 0.004 | 0.001 | 0.000 | 0.013 | 0.021 | 0.017 | 0.002 | 0.000 | 0.001 | 0.001 | 0.001 | 0.000 |
| Mn | 0.000 | 0.002 | 0.002 | 0.001 | 0.000 | 0.005 | 0.019 | 0.002 | 0.002 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 |
| Nb | 0.000 | 0.001 | 0.004 | 0.001 | 0.001 | 0.012 | 0.015 | 0.021 | 0.003 | 0.001 | 0.000 | 0.002 | 0.000 | 0.000 |
| Ta | 0.004 | 0.010 | 0.006 | 0.007 | 0.003 | 0.025 | 0.068 | 0.017 | 0.014 | 0.003 | 0.006 | 0.004 | 0.005 | 0.004 |
| | | | | | | | | | | | | | | |
| Total | 1.999 | 1.999 | 2.000 | 1.999 | 1.999 | 2.000 | 1.999 | 2.000 | 1.998 | 1.999 | 1.999 | 1.999 | 1.999 | 1.999 |
| | | | | | | | | | | | | | | |
| Sn end | 99.791 | 99.256 | 99.208 | 99.547 | 99.817 | 97.252 | 93.869 | 97.150 | 98.967 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 |
| FeMn end | 0.015 | 0.187 | 0.280 | 0.074 | 0.000 | 0.889 | 2.001 | 0.977 | 0.206 | 0.070 | 0.060 | 0.108 | 0.006 | 0.002 |
| NbTa end | 0.194 | 0.557 | 0.512 | 0.379 | 0.183 | 1.860 | 4.130 | 1.873 | 0.827 | 99.930 | 99.940 | 99.892 | 99.994 | 99.998 |
| | | | | | | | | | | | | | | |
| Nb+Ta | 0.004 | 0.011 | 0.010 | 0.008 | 0.004 | 0.037 | 0.083 | 0.037 | 0.017 | 0.004 | 0.007 | 0.006 | 0.005 | 0.004 |
| Fe+Mn | 0.000 | 0.004 | 0.006 | 0.001 | 0.000 | 0.018 | 0.040 | 0.020 | 0.004 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 |
| | | | | | | | | | | | | | | |
| Comments | NE & NF same grain | | NJ & NK same grain | | JE & JF same grain contains tiny inclusions brown | | many inclusions in grain JL. | | | AA & AB same grain contains tiny inclusions | | | AV & AW same grain | |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | **West pegmatite** | | | | | | | | **West pegmatite** | | |
| | | | | | | 97-WP1 | | | | | | | | 97-WP3 | | |
| | QA | QB | QC | QD | QE | QH | QI | QJ | QK | QO | QU | QV | DE | DJ | DO | DP |
| SnO2 | 98.54 | 98.04 | 98.06 | 98.33 | 97.12 | 98.70 | 98.79 | 96.95 | 97.46 | 97.46 | 95.61 | 97.56 | 99.40 | 98.68 | 98.06 | 98.46 |
| FeO | 0.31 | 0.23 | 0.29 | 0.21 | 0.42 | 0.10 | 0.13 | 0.48 | 0.37 | 0.38 | 0.66 | 0.26 | 0.08 | 0.24 | 0.32 | 0.24 |
| MnO | 0.02 | 0.00 | 0.00 | 0.01 | 0.03 | 0.00 | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 | 0.01 |
| Nb2O5 | 0.34 | 0.13 | 0.37 | 0.61 | 1.21 | 0.18 | 0.18 | 0.88 | 0.61 | 0.16 | 1.06 | 0.20 | 0.08 | 0.26 | 0.53 | 0.31 |
| Ta2O5 | 0.39 | 1.09 | 0.33 | 0.38 | 0.53 | 0.36 | 0.40 | 0.75 | 0.38 | 1.52 | 1.83 | 1.27 | 0.30 | 0.75 | 0.83 | 0.75 |
| Total | 99.59 | 99.49 | 99.04 | 99.54 | 99.31 | 99.33 | 99.49 | 99.07 | 98.84 | 99.51 | 99.17 | 99.31 | 99.87 | 99.94 | 99.74 | 99.77 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.977 | 1.973 | 1.978 | 1.971 | 1.947 | 1.987 | 1.985 | 1.952 | 1.968 | 1.962 | 1.924 | 1.966 | 1.991 | 1.975 | 1.964 | 1.973 |
| Fe | 0.013 | 0.010 | 0.012 | 0.009 | 0.017 | 0.004 | 0.005 | 0.020 | 0.016 | 0.016 | 0.028 | 0.011 | 0.003 | 0.010 | 0.013 | 0.010 |
| Mn | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 |
| Nb | 0.008 | 0.003 | 0.008 | 0.014 | 0.028 | 0.004 | 0.004 | 0.020 | 0.014 | 0.004 | 0.024 | 0.005 | 0.002 | 0.006 | 0.012 | 0.007 |
| Ta | 0.005 | 0.015 | 0.004 | 0.005 | 0.007 | 0.005 | 0.005 | 0.010 | 0.005 | 0.021 | 0.025 | 0.017 | 0.004 | 0.010 | 0.011 | 0.010 |
| Total | 2.004 | 2.000 | 2.003 | 2.000 | 2.001 | 2.000 | 2.000 | 2.003 | 2.003 | 2.002 | 2.002 | 2.000 | 2.000 | 2.001 | 2.001 | 2.001 |
| Sn end | 98.660 | 98.630 | 98.743 | 98.582 | 97.320 | 99.345 | 99.260 | 97.450 | 98.234 | 97.991 | 96.133 | 98.300 | 99.527 | 98.660 | 98.164 | 98.612 |
| FeMn end | 0.696 | 0.477 | 0.610 | 0.459 | 0.942 | 0.209 | 0.263 | 1.035 | 0.808 | 0.793 | 1.402 | 0.599 | 0.174 | 0.542 | 0.670 | 0.525 |
| NbTa end | 0.645 | 0.894 | 0.646 | 0.960 | 1.738 | 0.446 | 0.477 | 1.515 | 0.959 | 1.216 | 2.464 | 1.101 | 0.299 | 0.799 | 1.166 | 0.862 |
| Nb+Ta | 0.013 | 0.018 | 0.013 | 0.019 | 0.035 | 0.009 | 0.010 | 0.030 | 0.019 | 0.024 | 0.049 | 0.022 | 0.006 | 0.016 | 0.023 | 0.017 |
| Fe+Mn | 0.014 | 0.010 | 0.012 | 0.009 | 0.019 | 0.004 | 0.005 | 0.021 | 0.016 | 0.016 | 0.028 | 0.012 | 0.003 | 0.011 | 0.013 | 0.011 |
| Comments: | | QA - QD | | | | | | QJ & QK | | | QU & QV | | | | DO & DP | |
| | | same grain | | | | | | same grain | | | same grain | | | | same grain | |
| | brown | | brown | brown | | | | brown | brown | | brown | brown | | | | |
| | | colourless | | | | | | | | | | | | | | |
| | cassiterite is earlier than garnet | | | | | | | | | | | | | | | |

| | West pegmatite | | | | | | Big Mack | Big Mack pegmatite | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 97-WP3 | | | | | | 98-83E | 98-83G | | | | | | | | | |
| | NH | NI | NK | NM | NN | NO | KI | GA1 | GA2 | GA3 | GA4 | GA5 | GB1 | GB2 | GB3 | GB4 | GB5 |
| SnO2 | 95.51 | 98.17 | 99.02 | 97.08 | 97.88 | 98.27 | 96.57 | 92.41 | 92.99 | 93.28 | 94.63 | 93.76 | 94.25 | 97.67 | 95.62 | 97.29 | 93.83 |
| FeO | 0.67 | 0.16 | 0.15 | 0.48 | 0.26 | 0.19 | 0.46 | 1.20 | 1.07 | 1.08 | 0.86 | 1.03 | 0.74 | 0.23 | 0.57 | 0.41 | 0.91 |
| MnO | 0.01 | 0.00 | 0.00 | 0.02 | 0.02 | 0.02 | 0.13 | 0.01 | 0.04 | 0.01 | 0.00 | 0.12 | 0.01 | 0.01 | 0.02 | 0.01 | 0.02 |
| Nb2O5 | 0.48 | 0.13 | 0.06 | 0.49 | 0.20 | 0.15 | 1.13 | 1.64 | 1.62 | 1.64 | 1.64 | 1.99 | 0.88 | 0.09 | 1.05 | 0.77 | 0.75 |
| Ta2O5 | 2.53 | 0.81 | 0.72 | 1.83 | 0.98 | 0.67 | 1.47 | 3.97 | 3.54 | 3.30 | 2.36 | 3.09 | 2.73 | 1.30 | 1.67 | 1.02 | 3.87 |
| Total | 99.20 | 99.26 | 99.95 | 99.90 | 99.33 | 99.30 | 99.75 | 99.23 | 99.27 | 99.31 | 99.49 | 100.00 | 98.61 | 99.29 | 98.93 | 99.50 | 99.38 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | | |
| Sn | 1.928 | 1.979 | 1.983 | 1.944 | 1.972 | 1.980 | 1.931 | 1.860 | 1.870 | 1.874 | 1.895 | 1.867 | 1.912 | 1.970 | 1.929 | 1.952 | 1.892 |
| Fe | 0.028 | 0.007 | 0.006 | 0.020 | 0.011 | 0.008 | 0.019 | 0.051 | 0.045 | 0.045 | 0.036 | 0.043 | 0.031 | 0.010 | 0.024 | 0.017 | 0.039 |
| Mn | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 | 0.001 | 0.006 | 0.000 | 0.002 | 0.000 | 0.000 | 0.005 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 |
| Nb | 0.011 | 0.003 | 0.001 | 0.011 | 0.005 | 0.003 | 0.026 | 0.038 | 0.037 | 0.037 | 0.037 | 0.045 | 0.020 | 0.002 | 0.024 | 0.018 | 0.017 |
| Ta | 0.035 | 0.011 | 0.010 | 0.025 | 0.013 | 0.009 | 0.020 | 0.054 | 0.049 | 0.045 | 0.032 | 0.042 | 0.038 | 0.018 | 0.023 | 0.014 | 0.053 |
| Total | 2.003 | 2.000 | 2.000 | 2.001 | 2.001 | 2.001 | 2.001 | 2.003 | 2.002 | 2.002 | 2.001 | 2.002 | 2.001 | 2.000 | 2.001 | 2.001 | 2.002 |
| Sn end | 96.279 | 98.963 | 99.125 | 97.152 | 98.512 | 98.926 | 96.487 | 92.858 | 93.377 | 93.592 | 94.706 | 93.253 | 95.512 | 98.500 | 96.402 | 97.556 | 94.520 |
| FeMn end | 1.436 | 0.340 | 0.321 | 1.048 | 0.590 | 0.444 | 1.236 | 2.548 | 2.349 | 2.279 | 1.822 | 2.406 | 1.588 | 0.508 | 1.252 | 0.864 | 1.970 |
| NbTa end | 2.285 | 0.696 | 0.554 | 1.800 | 0.899 | 0.630 | 2.277 | 4.593 | 4.273 | 4.129 | 3.472 | 4.341 | 2.900 | 0.992 | 2.345 | 1.580 | 3.511 |
| Nb+Ta | 0.046 | 0.014 | 0.011 | 0.036 | 0.018 | 0.013 | 0.046 | 0.092 | 0.086 | 0.083 | 0.069 | 0.087 | 0.058 | 0.020 | 0.047 | 0.032 | 0.070 |
| Fe+Mn | 0.029 | 0.007 | 0.006 | 0.021 | 0.012 | 0.009 | 0.025 | 0.051 | 0.047 | 0.046 | 0.036 | 0.048 | 0.032 | 0.010 | 0.025 | 0.017 | 0.039 |
| Comments: | NH & NI<br>same grain | | | NM - NO same grain<br>contains inclusions<br>of manganocolumbite<br>dark brown | brown | | single<br>tiny<br>grain | 500 µm traverse across grain | | | | | 820 µm traverse across grain<br>contains inclusions<br>of ferrotantalite | | | | |

| | | | Big Mack pegmatite | | | | Big Whopper pegmatite | | | | | | Big Whopper lepidolite unit | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | 98-38G | | | | 98-ATBW1 | | | | | | 98-SS27 | | | | | |
| | GB6 | GB7 | GB8 | GB9 | GB10 | BF | BG | BH | BI | HE | HF | HH | HI | WH | WI | WJ | WK | WM |
| SnO2 | 95.04 | 96.87 | 96.92 | 97.84 | 96.27 | 99.10 | 97.05 | 99.44 | 96.27 | 98.68 | 98.83 | 99.65 | 99.67 | 99.28 | 99.64 | 99.50 | 89.74 | 100.85 |
| FeO | 0.70 | 0.48 | 0.43 | 0.43 | 0.53 | 0.08 | 0.24 | 0.09 | 0.37 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.31 | 0.03 |
| MnO | 0.04 | 0.02 | 0.04 | 0.03 | 0.06 | 0.02 | 0.08 | 0.02 | 0.19 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.03 | 1.00 | 0.00 |
| Nb2O5 | 1.03 | 1.12 | 1.18 | 0.70 | 1.24 | 0.32 | 0.27 | 0.16 | 1.21 | 0.07 | 0.06 | 0.02 | 0.00 | 0.18 | 0.01 | 0.13 | 0.92 | 0.00 |
| Ta2O5 | 2.40 | 0.95 | 0.81 | 0.65 | 1.21 | 0.41 | 1.95 | 0.38 | 1.57 | 0.26 | 0.30 | 0.09 | 0.13 | 0.22 | 0.12 | 0.43 | 7.65 | 0.10 |
| Total | 99.21 | 99.43 | 99.36 | 99.65 | 99.31 | 99.92 | 99.59 | 100.08 | 99.61 | 99.01 | 99.21 | 99.77 | 99.81 | 99.69 | 99.77 | 100.09 | 99.61 | 100.98 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | | | |
| Sn | 1.914 | 1.942 | 1.943 | 1.959 | 1.932 | 1.982 | 1.952 | 1.987 | 1.927 | 1.993 | 1.993 | 1.998 | 1.998 | 1.991 | 1.998 | 1.988 | 1.814 | 1.998 |
| Fe | 0.030 | 0.020 | 0.018 | 0.018 | 0.022 | 0.003 | 0.010 | 0.004 | 0.016 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.013 | 0.001 |
| Mn | 0.002 | 0.001 | 0.002 | 0.001 | 0.003 | 0.001 | 0.003 | 0.001 | 0.008 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.043 | 0.000 |
| Nb | 0.023 | 0.025 | 0.027 | 0.016 | 0.028 | 0.007 | 0.006 | 0.004 | 0.027 | 0.002 | 0.001 | 0.000 | 0.000 | 0.004 | 0.000 | 0.003 | 0.021 | 0.000 |
| Ta | 0.033 | 0.013 | 0.011 | 0.009 | 0.017 | 0.006 | 0.027 | 0.005 | 0.021 | 0.004 | 0.004 | 0.001 | 0.002 | 0.003 | 0.002 | 0.006 | 0.105 | 0.001 |
| Total | 2.002 | 2.001 | 2.000 | 2.004 | 2.001 | 1.999 | 1.999 | 2.000 | 2.000 | 1.999 | 1.999 | 2.000 | 2.000 | 1.998 | 2.000 | 1.998 | 1.996 | 2.000 |
| Sn end | 95.609 | 97.027 | 97.141 | 97.793 | 96.525 | 99.147 | 97.676 | 99.329 | 96.374 | 99.725 | 99.697 | 99.883 | 99.895 | 99.636 | 99.903 | 99.491 | 90.871 | 99.881 |
| FeMn end | 1.577 | 1.057 | 0.970 | 0.976 | 1.234 | 0.210 | 0.678 | 0.231 | 1.181 | 0.017 | 0.026 | 0.040 | 0.013 | 0.004 | 0.000 | 0.068 | 2.794 | 0.052 |
| NbTa end | 2.314 | 1.915 | 1.889 | 1.231 | 2.241 | 0.643 | 1.647 | 0.440 | 2.445 | 0.257 | 0.277 | 0.077 | 0.093 | 0.359 | 0.097 | 0.441 | 6.335 | 0.068 |
| Nb+Ta | 0.056 | 0.038 | 0.038 | 0.025 | 0.045 | 0.013 | 0.033 | 0.009 | 0.049 | 0.005 | 0.006 | 0.002 | 0.002 | 0.007 | 0.002 | 0.009 | 0.126 | 0.001 |
| Fe+Mn | 0.032 | 0.021 | 0.019 | 0.020 | 0.025 | 0.004 | 0.014 | 0.005 | 0.024 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.056 | 0.001 |
| Comments: | | | | | | BF & BG<br>same grain<br>core rim<br>Avalon Resources trench | | | | | exceptionally pure cassiterite | | | | | | exceptionally pure cassiterite<br>apart from WK | |

|  | **Big Whopper** |  |  |  |  |  |  |  |  |  |  |  |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
|  |  |  | **SW Beryl pegmatite** |  |  |  |  |  |  |  |  |  |  |
|  | 98-SS29 |  | 99-AT6081 |  |  |  |  |  |  |  |  |  |  |
|  | PF1 | PF2 | BA | BB | BF | BG | BH1 | BH2 | BH3 | BH4 | BJ | BN1 | BN2 |
| SnO2 | 99.62 | 98.57 | 99.10 | 97.80 | 98.39 | 95.20 | 97.74 | 99.61 | 97.87 | 97.54 | 96.80 | 95.73 | 97.39 |
| FeO | 0.00 | 0.05 | 0.24 | 0.13 | 0.15 | 0.84 | 0.44 | 0.06 | 0.39 | 0.35 | 0.48 | 0.72 | 0.39 |
| MnO | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.01 | 0.02 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 | 0.00 |
| Nb2O5 | 0.00 | 0.01 | 0.40 | 0.06 | 0.01 | 1.14 | 0.54 | 0.14 | 0.54 | 0.44 | 0.61 | 1.12 | 0.69 |
| Ta2O5 | 0.08 | 0.32 | 0.46 | 0.80 | 0.66 | 2.38 | 0.88 | 0.20 | 1.09 | 0.96 | 1.31 | 2.03 | 0.91 |
| Total | 99.70 | 98.96 | 100.20 | 98.79 | 99.21 | 99.56 | 99.61 | 100.01 | 99.89 | 99.33 | 99.20 | 99.61 | 99.38 |
|  | **Structural formulae based on 4 oxygens** |  |  |  |  |  |  |  |  |  |  |  |  |
| Sn | 1.999 | 1.993 | 1.976 | 1.982 | 1.985 | 1.909 | 1.960 | 1.992 | 1.958 | 1.963 | 1.950 | 1.918 | 1.957 |
| Fe | 0.000 | 0.000 | 0.010 | 0.006 | 0.006 | 0.035 | 0.019 | 0.002 | 0.016 | 0.015 | 0.020 | 0.030 | 0.016 |
| Mn | 0.000 | 0.002 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 |
| Nb | 0.000 | 0.000 | 0.009 | 0.001 | 0.000 | 0.026 | 0.012 | 0.003 | 0.012 | 0.010 | 0.014 | 0.026 | 0.016 |
| Ta | 0.001 | 0.004 | 0.006 | 0.011 | 0.009 | 0.032 | 0.012 | 0.003 | 0.015 | 0.013 | 0.018 | 0.028 | 0.012 |
| Total | 2.000 | 2.000 | 2.001 | 2.000 | 2.001 | 2.003 | 2.004 | 2.000 | 2.001 | 2.002 | 2.002 | 2.002 | 2.001 |
| Sn end | 100.00 | 99.892 | 24.461 | 61.514 | 57.909 | 34.540 | 27.565 | 33.368 | 34.222 | 33.448 | 34.467 | 33.126 | 28.099 |
| FeMn end | 0.000 | 0.000 | 38.760 | 31.053 | 40.497 | 37.417 | 42.770 | 29.099 | 37.489 | 37.315 | 38.513 | 36.033 | 36.572 |
| NbTa end | 0.000 | 0.108 | 36.779 | 7.433 | 1.595 | 28.042 | 29.665 | 37.533 | 28.289 | 29.237 | 27.020 | 30.842 | 35.328 |
| Nb+Ta | 0.001 | 0.004 | 0.015 | 0.012 | 0.009 | 0.058 | 0.024 | 0.006 | 0.027 | 0.023 | 0.032 | 0.053 | 0.028 |
| Fe+Mn | 0.000 | 0.002 | 0.010 | 0.006 | 0.006 | 0.036 | 0.019 | 0.002 | 0.016 | 0.016 | 0.020 | 0.030 | 0.016 |
| Comments: |  |  | 99-ATZ11 is a cassiterite-rich sample from which many individual grains were recovered (some up to 1 cm in length) |  |  |  |  |  |  |  |  | contains ferrocolumbite inclusions |  |

**SW Beryl pegmatite**

99-AT6081

| | AA1 | AA2 | AA3 | AA4 | AA5 | AA6 | AA7 |
|---|---|---|---|---|---|---|---|
| SnO2 | 98.03 | 96.67 | 97.07 | 96.78 | 95.62 | 96.47 | 96.81 |
| FeO | 0.19 | 0.49 | 0.40 | 0.49 | 0.67 | 0.60 | 0.53 |
| MnO | 0.01 | 0.00 | 0.02 | 0.01 | 0.03 | 0.01 | 0.01 |
| Nb2O5 | 0.43 | 0.98 | 0.72 | 0.92 | 1.17 | 0.79 | 0.69 |
| Ta2O5 | 0.45 | 1.08 | 0.97 | 0.99 | 1.72 | 1.64 | 1.54 |
| Total | 99.11 | 99.22 | 99.17 | 99.18 | 99.21 | 99.51 | 99.58 |
| | **Structural formulae based on 4 oxygens** | | | | | | |
| Sn | 1.976 | 1.943 | 1.954 | 1.946 | 1.922 | 1.937 | 1.943 |
| Fe | 0.008 | 0.021 | 0.017 | 0.021 | 0.028 | 0.025 | 0.022 |
| Mn | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 |
| Nb | 0.010 | 0.022 | 0.016 | 0.021 | 0.027 | 0.018 | 0.016 |
| Ta | 0.006 | 0.015 | 0.013 | 0.014 | 0.024 | 0.023 | 0.021 |
| Total | 2.000 | 2.001 | 2.001 | 2.002 | 2.002 | 2.003 | 2.002 |
| Sn end | 25.493 | 25.645 | 28.029 | 24.459 | 29.506 | 34.100 | 35.733 |
| FeMn end | 32.577 | 35.713 | 35.297 | 37.150 | 35.206 | 38.271 | 37.364 |
| NbTa end | 41.931 | 38.642 | 36.674 | 38.391 | 35.288 | 27.628 | 26.902 |
| Nb+Ta | 0.016 | 0.037 | 0.030 | 0.034 | 0.050 | 0.040 | 0.037 |
| Fe+Mn | 0.008 | 0.021 | 0.018 | 0.021 | 0.030 | 0.026 | 0.022 |

Comments:

4600 µm traverse

cassiterite-rich zone at margin of pegmatite

**SW Beryl pegmatite**

99-AT6081

| | AB1 | AB2 | AB3 | AB4 | AB5 | AB6 | AB7 | AB8 | AB9 |
|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 98.86 | 99.27 | 95.33 | 98.01 | 99.12 | 95.19 | 99.12 | 98.53 | 95.87 |
| FeO | 0.08 | 0.08 | 0.81 | 0.30 | 0.12 | 0.84 | 0.11 | 0.27 | 0.74 |
| MnO | 0.00 | 0.00 | 0.02 | 0.02 | 0.00 | 0.01 | 0.00 | 0.01 | 0.06 |
| Nb2O5 | 0.17 | 0.09 | 1.12 | 0.17 | 0.11 | 1.13 | 0.10 | 0.28 | 1.82 |
| Ta2O5 | 0.16 | 0.22 | 2.44 | 1.15 | 0.26 | 2.54 | 0.28 | 0.90 | 1.89 |
| | | | | | | | | | |
| Total | 99.27 | 99.66 | 99.72 | 99.65 | 99.62 | 99.71 | 99.61 | 99.99 | 100.38 |
| | | | | | | | | | |
| **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.991 | 1.992 | 1.909 | 1.969 | 1.990 | 1.907 | 1.990 | 1.971 | 1.900 |
| Fe | 0.003 | 0.003 | 0.034 | 0.012 | 0.005 | 0.035 | 0.005 | 0.011 | 0.031 |
| Mn | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.001 | 0.003 |
| Nb | 0.004 | 0.002 | 0.025 | 0.004 | 0.003 | 0.026 | 0.002 | 0.006 | 0.041 |
| Ta | 0.002 | 0.003 | 0.033 | 0.016 | 0.004 | 0.035 | 0.004 | 0.012 | 0.026 |
| | | | | | | | | | |
| Total | 2.000 | 2.000 | 2.003 | 2.002 | 2.001 | [illegible].003 | 2.001 | 2.001 | 2.000 |
| | | | | | | | | | |
| Sn end | 23.415 | 36.895 | 35.649 | 47.894 | 31.491 | 36.078 | 34.899 | 40.114 | 25.555 |
| FeMn end | 35.558 | 39.176 | 36.467 | 37.876 | 44.922 | 36.618 | 42.851 | 37.418 | 30.985 |
| NbTa end | 41.027 | 23.929 | 27.884 | 14.231 | 23.587 | 27.304 | 22.251 | 22.468 | 43.460 |
| | | | | | | | | | |
| Nb+Ta | 0.006 | 0.005 | 0.059 | 0.020 | 0.006 | 0.060 | 0.006 | 0.019 | 0.066 |
| Fe+Mn | 0.003 | 0.003 | 0.035 | 0.013 | 0.005 | 0.036 | 0.005 | 0.012 | 0.033 |

Comments: 4500 µm traverse
contains ferrocolumbite inclusions

**SW Beryl pegmatite**

99-AT6081

| | AC1 | AC2 | AC3 | AC4 | AD1 | AD2 | AD3 | AD4 | AD5 |
|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.25 | 96.65 | 97.47 | 98.08 | 97.05 | 96.21 | 97.41 | 97.31 | 98.59 |
| FeO | 0.07 | 0.55 | 0.33 | 0.40 | 0.40 | 0.64 | 0.50 | 0.51 | 0.38 |
| MnO | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.02 | 0.00 | 0.02 | 0.00 |
| Nb2O5 | 0.06 | 0.82 | 0.45 | 0.46 | 0.56 | 0.94 | 0.74 | 0.77 | 0.64 |
| Ta2O5 | 0.14 | 1.64 | 0.97 | 1.09 | 1.21 | 1.69 | 1.27 | 1.26 | 0.62 |
| Total | 99.51 | 99.66 | 99.23 | 100.03 | 99.22 | 99.49 | 99.92 | 99.86 | 100.23 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.995 | 1.937 | 1.963 | 1.960 | 1.955 | 1.931 | 1.947 | 1.946 | 1.963 |
| Fe | 0.003 | 0.023 | 0.014 | 0.017 | 0.017 | 0.027 | 0.021 | 0.021 | 0.016 |
| Mn | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Nb | 0.001 | 0.019 | 0.010 | 0.010 | 0.013 | 0.021 | 0.017 | 0.017 | 0.014 |
| Ta | 0.002 | 0.022 | 0.013 | 0.015 | 0.017 | 0.023 | 0.017 | 0.017 | 0.008 |
| Total | 2.001 | 2.001 | 2.001 | 2.002 | 2.001 | 2.003 | 2.002 | 2.002 | 2.002 |
| Sn end | 31.533 | 34.924 | 35.039 | 35.554 | 35.965 | 32.061 | 31.245 | 30.390 | 21.695 |
| FeMn end | 47.423 | 36.171 | 36.730 | 39.548 | 36.470 | 37.367 | 38.206 | 37.811 | 41.253 |
| NbTa end | 21.045 | 28.905 | 28.231 | 24.898 | 27.565 | 30.572 | 30.549 | 31.799 | 37.052 |
| Nb+Ta | 0.003 | 0.041 | 0.024 | 0.025 | 0.029 | 0.044 | 0.034 | 0.035 | 0.023 |
| Fe+Mn | 0.003 | 0.023 | 0.014 | 0.017 | 0.017 | 0.028 | 0.021 | 0.022 | 0.016 |
| Comments: | | 3000 µm traverse | | | | 3000 µm traverse | | | |

**SW Beryl pegmatite**

99-AT6081

| | AE1 | AE2 | AE3 | AE4 | AF1 | AF2 | AF3 | AF4 | AF5 | AF6 | AF7 | AF8 | AF9 | AF10 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 97.29 | 98.54 | 95.87 | 94.01 | 96.42 | 95.85 | 95.65 | 96.13 | 95.50 | 96.38 | 96.32 | 96.31 | 96.65 | 96.90 |
| FeO | 0.51 | 0.16 | 0.69 | 0.96 | 0.53 | 0.76 | 0.71 | 0.68 | 0.78 | 0.69 | 0.53 | 0.62 | 0.51 | 0.55 |
| MnO | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.00 | 0.03 | 0.00 | 0.01 |
| Nb2O5 | 0.98 | 0.12 | 1.38 | 1.44 | 0.72 | 1.03 | 1.01 | 0.87 | 1.08 | 1.03 | 0.70 | 0.84 | 0.67 | 0.68 |
| Ta2O5 | 1.00 | 0.67 | 1.48 | 2.69 | 1.55 | 2.24 | 2.00 | 2.14 | 2.33 | 1.97 | 1.65 | 1.68 | 1.45 | 1.56 |
| | | | | | | | | | | | | | | |
| Total | 99.78 | 99.49 | 99.44 | 99.12 | 99.22 | 99.87 | 99.37 | 99.83 | 99.69 | 100.06 | 99.20 | 99.47 | 99.28 | 99.70 |
| | | | | | | | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.945 | 1.982 | 1.921 | 1.892 | 1.942 | 1.917 | 1.922 | 1.924 | 1.913 | 1.923 | 1.941 | 1.934 | 1.945 | 1.942 |
| Fe | 0.021 | 0.007 | 0.029 | 0.041 | 0.023 | 0.032 | 0.030 | 0.028 | 0.033 | 0.029 | 0.022 | 0.026 | 0.021 | 0.023 |
| Mn | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 |
| Nb | 0.022 | 0.003 | 0.031 | 0.033 | 0.016 | 0.023 | 0.023 | 0.020 | 0.024 | 0.023 | 0.016 | 0.019 | 0.015 | 0.015 |
| Ta | 0.014 | 0.009 | 0.020 | 0.037 | 0.021 | 0.031 | 0.027 | 0.029 | 0.032 | 0.027 | 0.023 | 0.023 | 0.020 | 0.021 |
| | | | | | | | | | | | | | | |
| Total | 2.002 | 2.001 | 2.002 | 2.003 | 2.002 | 2.002 | 2.002 | 2.002 | 2.003 | 2.002 | 2.002 | 2.003 | 2.002 | 2.003 |
| | | | | | | | | | | | | | | |
| Sn end | 23.801 | 48.703 | 24.922 | 33.305 | 35.208 | 35.751 | 34.142 | 37.735 | 35.489 | 33.918 | 37.259 | 33.184 | 35.145 | 35.448 |
| FeMn end | 37.147 | 35.648 | 35.448 | 36.589 | 37.421 | 37.039 | 36.991 | 36.696 | 36.801 | 36.482 | 36.715 | 37.545 | 37.838 | 38.341 |
| NbTa end | 39.052 | 15.649 | 39.629 | 30.106 | 27.371 | 27.210 | 28.868 | 25.569 | 27.710 | 29.600 | 26.027 | 29.271 | 27.018 | 26.211 |
| | | | | | | | | | | | | | | |
| Nb+Ta | 0.036 | 0.012 | 0.052 | 0.070 | 0.038 | 0.054 | 0.051 | 0.049 | 0.056 | 0.050 | 0.039 | 0.042 | 0.035 | 0.037 |
| Fe+Mn | 0.021 | 0.007 | 0.030 | 0.041 | 0.023 | 0.032 | 0.030 | 0.029 | 0.033 | 0.029 | 0.022 | 0.027 | 0.021 | 0.023 |
| | | | | | | | | | | | | | | |
| Comments: | | | | 4000 μm traverse contains ferrocolumbite inclusions | | | | | | 3100 μm traverse | | | | |

**Glitter pegmatite**

99-GZ1

| | AA | AB | AC | AD | AE | AG | AH | AI |
|---|---|---|---|---|---|---|---|---|
| SnO2 | 97.45 | 96.93 | 98.89 | 97.16 | 98.62 | 99.04 | 98.77 | 99.31 |
| FeO | 0.55 | 0.56 | 0.22 | 0.45 | 0.25 | 0.28 | 0.31 | 0.19 |
| MnO | 0.03 | 0.00 | 0.00 | 0.00 | 0.01 | 0.00 | 0.02 | 0.01 |
| Nb2O5 | 1.88 | 0.73 | 0.42 | 0.18 | 0.47 | 0.42 | 0.68 | 0.38 |
| Ta2O5 | 0.30 | 1.82 | 0.09 | 2.00 | 0.39 | 0.14 | 0.33 | 0.02 |
| | | | | | | | | |
| Total | 100.20 | 100.03 | 99.62 | 99.34 | 99.74 | 99.88 | 100.10 | 99.91 |
| | | | | | | | | |
| | **Structural formulae based on 4 oxygens** | | | | | | | |
| Sn | 1.930 | 1.937 | 1.982 | 1.951 | 1.975 | 1.980 | 1.968 | 1.985 |
| Fe | 0.023 | 0.023 | 0.009 | 0.019 | 0.010 | 0.012 | 0.013 | 0.008 |
| Mn | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 |
| Nb | 0.042 | 0.017 | 0.009 | 0.004 | 0.011 | 0.010 | 0.015 | 0.009 |
| Ta | 0.004 | 0.025 | 0.001 | 0.027 | 0.005 | 0.002 | 0.005 | 0.000 |
| | | | | | | | | |
| Total | 2.001 | 2.001 | 2.002 | 2.002 | 2.001 | 2.003 | 2.002 | 2.002 |
| | | | | | | | | |
| Sn end | 96.483 | 96.772 | 99.001 | 97.482 | 98.666 | 98.843 | 98.330 | 99.129 |
| FeMn end | 1.212 | 1.162 | 0.466 | 0.949 | 0.531 | 0.584 | 0.679 | 0.430 |
| NbTa end | 2.306 | 2.066 | 0.533 | 1.569 | 0.803 | 0.573 | 0.991 | 0.442 |
| | | | | | | | | |
| Nb+Ta | 0.046 | 0.041 | 0.011 | 0.031 | 0.016 | 0.011 | 0.020 | 0.009 |
| Fe+Mn | 0.024 | 0.023 | 0.009 | 0.019 | 0.011 | 0.012 | 0.014 | 0.009 |
| | | | | | | | | |
| Comments: | | AA - AD<br>same grain<br>contains many inclusions | | | | contains<br>ferrotapiolite<br>inclusion AF | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | **Glitter pegmatite** | | | | | | | | | |
| | 99-GZ4 | | | | | | | | | |
| | DA | DG | DO | DC2 | DD2 | DE2 | EM | EQ | ET | EX |
| SnO2 | 99.64 | 98.51 | 99.10 | 98.60 | 99.04 | 98.15 | 98.99 | 96.93 | 98.40 | 98.84 |
| FeO | 0.08 | 0.26 | 0.15 | 0.16 | 0.12 | 0.34 | 0.14 | 0.31 | 0.26 | 0.16 |
| MnO | 0.00 | 0.01 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.04 | 0.05 | 0.01 |
| Nb2O5 | 0.11 | 0.36 | 0.09 | 0.13 | 0.11 | 0.34 | 0.10 | 0.12 | 0.11 | 0.13 |
| Ta2O5 | 0.38 | 1.13 | 0.67 | 0.80 | 0.48 | 1.41 | 0.64 | 1.98 | 0.81 | 0.71 |
| Total | 100.21 | 100.27 | 100.01 | 99.69 | 99.75 | 100.25 | 99.87 | 99.36 | 99.62 | 99.85 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | |
| Sn | 1.989 | 1.965 | 1.983 | 1.979 | 1.986 | 1.959 | 1.983 | 1.955 | 1.977 | 1.981 |
| Fe | 0.003 | 0.011 | 0.006 | 0.007 | 0.005 | 0.014 | 0.006 | 0.013 | 0.011 | 0.007 |
| Mn | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.002 | 0.001 |
| Nb | 0.003 | 0.008 | 0.002 | 0.003 | 0.002 | 0.008 | 0.002 | 0.003 | 0.002 | 0.003 |
| Ta | 0.005 | 0.015 | 0.009 | 0.011 | 0.007 | 0.019 | 0.009 | 0.027 | 0.011 | 0.010 |
| Total | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 2.003 | 2.000 |
| Sn end | 99.444 | 98.243 | 99.125 | 98.962 | 99.302 | 97.918 | 99.150 | 97.784 | 98.681 | 99.006 |
| FeMn end | 0.172 | 0.578 | 0.319 | 0.347 | 0.248 | 0.735 | 0.305 | 0.722 | 0.647 | 0.360 |
| NbTa end | 0.384 | 1.180 | 0.556 | 0.691 | 0.449 | 1.347 | 0.545 | 1.494 | 0.672 | 0.634 |
| Nb+Ta | 0.008 | 0.024 | 0.011 | 0.014 | 0.009 | 0.027 | 0.011 | 0.030 | 0.013 | 0.013 |
| Fe+Mn | 0.003 | 0.012 | 0.006 | 0.007 | 0.005 | 0.015 | 0.006 | 0.014 | 0.013 | 0.007 |
| Comments: | DA - DE2 same grain | | | | | | | | inclusion | |
| | this sample contains large cassiterite grains containing | | | | | | | | in garnet | |
| | many inclusions of ferrocolumbite, and less common ferrotapiolite | | | | | | | | | |

| | **Glitter pegmatite** | | | | | | **Glitter peg.** | |
|---|---|---|---|---|---|---|---|---|
| | 99-GZ5 | | | | | | 99-GZ6 | |
| | BA | BB | BG | BH | BM | BB2 | CC | CE |
| SnO2 | 97.88 | 97.32 | 98.89 | 97.80 | 96.72 | 97.98 | 97.34 | 97.66 |
| FeO | 0.34 | 0.35 | 0.20 | 0.35 | 0.35 | 0.27 | 0.29 | 0.18 |
| MnO | 0.00 | 0.01 | 0.00 | 0.00 | 0.04 | 0.02 | 0.00 | 0.01 |
| Nb2O5 | 0.17 | 0.21 | 0.08 | 0.13 | 0.66 | 0.17 | 0.12 | 0.09 |
| Ta2O5 | 1.65 | 1.68 | 1.05 | 1.89 | 1.52 | 1.23 | 1.45 | 1.13 |
| Total | 100.03 | 99.56 | 100.22 | 100.16 | 99.28 | 99.68 | 99.19 | 99.06 |
| | **Structural formulae based on 4 oxygens** | | | | | | | |
| Sn | 1.960 | 1.958 | 1.976 | 1.957 | 1.947 | 1.968 | 1.966 | 1.974 |
| Fe | 0.014 | 0.015 | 0.008 | 0.015 | 0.015 | 0.011 | 0.012 | 0.008 |
| Mn | 0.000 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 |
| Nb | 0.004 | 0.005 | 0.002 | 0.003 | 0.015 | 0.004 | 0.003 | 0.002 |
| Ta | 0.023 | 0.023 | 0.014 | 0.026 | 0.021 | 0.017 | 0.020 | 0.016 |
| Total | 2.001 | 2.001 | 2.000 | 2.000 | 1.999 | 2.001 | 2.000 | 2.000 |
| Sn end | 97.972 | 97.860 | 98.778 | 97.834 | 97.398 | 98.344 | 98.257 | 98.716 |
| FeMn end | 0.714 | 0.749 | 0.417 | 0.732 | 0.806 | 0.615 | 0.610 | 0.401 |
| NbTa end | 1.314 | 1.391 | 0.805 | 1.434 | 1.796 | 1.041 | 1.134 | 0.884 |
| Nb+Ta | 0.026 | 0.028 | 0.016 | 0.029 | 0.036 | 0.021 | 0.023 | 0.018 |
| Fe+Mn | 0.014 | 0.015 | 0.008 | 0.015 | 0.016 | 0.012 | 0.012 | 0.008 |
| Comments: | BA & BB<br>same grain<br>contains many<br>inclusions<br>of ferrowodginite | | | | | | CC contains<br>ferrocolumbite<br>inclusion | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Wolf pegmatite** | | | | | | | | | **Wolf pegmatite** | | | | | |
| | 99-WZ1 | | | | | | | | | 99-WZ2 | | | | | |
| | GA | GB | GH | GI | GJ | GK | GL | GM | GN | JG | JH | JI | JJ | JK | JL |
| SnO2 | 98.87 | 96.98 | 94.89 | 99.66 | 95.73 | 96.69 | 99.75 | 97.18 | 99.85 | 95.90 | 99.72 | 96.21 | 99.14 | 97.31 | 99.21 |
| FeO | 0.15 | 0.43 | 0.85 | 0.07 | 0.62 | 0.54 | 0.06 | 0.37 | 0.05 | 0.57 | 0.10 | 0.62 | 0.14 | 0.43 | 0.16 |
| MnO | 0.01 | 0.01 | 0.06 | 0.02 | 0.03 | 0.04 | 0.00 | 0.01 | 0.01 | 0.05 | 0.00 | 0.02 | 0.00 | 0.03 | 0.01 |
| Nb2O5 | 0.12 | 0.50 | 0.86 | 0.07 | 0.57 | 0.49 | 0.09 | 0.30 | 0.02 | 0.56 | 0.15 | 0.59 | 0.11 | 0.46 | 0.14 |
| Ta2O5 | 0.90 | 1.92 | 3.53 | 0.47 | 2.97 | 2.53 | 0.20 | 1.71 | 0.53 | 2.85 | 0.47 | 2.81 | 0.69 | 2.08 | 0.95 |
| Total | 100.05 | 99.84 | 100.20 | 100.29 | 99.92 | 100.27 | 100.10 | 99.57 | 100.46 | 99.92 | 100.45 | 100.26 | 100.08 | 100.30 | 100.46 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | |
| Sn | 1.978 | 1.944 | 1.896 | 1.988 | 1.919 | 1.931 | 1.993 | 1.954 | 1.989 | 1.923 | 1.986 | 1.922 | 1.982 | 1.942 | 1.977 |
| Fe | 0.006 | 0.018 | 0.036 | 0.003 | 0.026 | 0.022 | 0.002 | 0.016 | 0.002 | 0.024 | 0.004 | 0.026 | 0.006 | 0.018 | 0.007 |
| Mn | 0.000 | 0.000 | 0.003 | 0.001 | 0.001 | 0.002 | 0.000 | 0.001 | 0.000 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.000 |
| Nb | 0.003 | 0.011 | 0.019 | 0.002 | 0.013 | 0.011 | 0.002 | 0.007 | 0.000 | 0.013 | 0.003 | 0.013 | 0.002 | 0.010 | 0.003 |
| Ta | 0.012 | 0.026 | 0.048 | 0.006 | 0.041 | 0.034 | 0.003 | 0.023 | 0.007 | 0.039 | 0.006 | 0.038 | 0.009 | 0.028 | 0.013 |
| Total | 2.000 | 2.000 | 2.002 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 1.999 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 1.999 |
| Sn end | 98.921 | 97.199 | 94.711 | 99.422 | 95.965 | 96.526 | 99.635 | 97.681 | 99.499 | 96.131 | 99.288 | 96.065 | 99.120 | 97.112 | 98.856 |
| FeMn end | 0.334 | 0.923 | 1.913 | 0.178 | 1.355 | 1.199 | 0.130 | 0.806 | 0.121 | 1.288 | 0.226 | 1.349 | 0.283 | 0.953 | 0.345 |
| NbTa end | 0.746 | 1.878 | 3.376 | 0.400 | 2.680 | 2.275 | 0.235 | 1.514 | 0.379 | 2.581 | 0.486 | 2.585 | 0.597 | 1.935 | 0.799 |
| Nb+Ta | 0.015 | 0.038 | 0.068 | 0.008 | 0.054 | 0.046 | 0.005 | 0.030 | 0.008 | 0.052 | 0.010 | 0.052 | 0.012 | 0.039 | 0.016 |
| Fe+Mn | 0.007 | 0.018 | 0.038 | 0.004 | 0.027 | 0.024 | 0.003 | 0.016 | 0.002 | 0.026 | 0.005 | 0.027 | 0.006 | 0.019 | 0.007 |
| Comments: | GA & GB | | GH - GJ | | | GK - GN | | | | JG - JI | | | | | |
| | same grain | | same grain | | | same grain | | | | same grain | | | colourless | | pale |
| | brown | | red | | red | red | | brown rim | | pink | | red | | pink | brown |
| | | colourless | | colourless | | | colourless | | black rim | | colourless | | | | |

| | **Wolf pegmatite** | | | | | | | **Wolf pegmatite** | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 99-WZ3 | | | | | | | 99-WZ4 | | | | | | |
| | FA | FB | FC | FD | FE | FG | FH | DB | DC | DG | DH | DM | DN | DQ |
| SnO2 | 98.91 | 97.86 | 98.39 | 97.01 | 96.14 | 99.94 | 94.90 | 99.29 | 97.32 | 98.95 | 96.15 | 96.54 | 96.41 | 99.10 |
| FeO | 0.19 | 0.32 | 0.26 | 0.46 | 0.59 | 0.06 | 0.74 | 0.14 | 0.47 | 0.21 | 0.59 | 0.48 | 0.49 | 0.10 |
| MnO | 0.01 | 0.02 | 0.02 | 0.02 | 0.02 | 0.00 | 0.03 | 0.00 | 0.00 | 0.00 | 0.03 | 0.02 | 0.05 | 0.00 |
| Nb2O5 | 0.14 | 0.34 | 0.25 | 0.49 | 0.64 | 0.05 | 0.77 | 0.15 | 0.39 | 0.23 | 0.55 | 0.42 | 0.43 | 0.15 |
| Ta2O5 | 0.87 | 1.48 | 1.22 | 2.01 | 2.66 | 0.27 | 3.26 | 0.72 | 2.16 | 0.91 | 2.83 | 2.28 | 2.34 | 0.44 |
| | | | | | | | | | | | | | | |
| Total | 100.13 | 100.01 | 100.14 | 99.98 | 100.05 | 100.32 | 99.71 | 100.31 | 100.34 | 100.29 | 100.15 | 99.74 | 99.72 | 99.78 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.977 | 1.958 | 1.966 | 1.942 | 1.924 | 1.993 | 1.906 | 1.981 | 1.942 | 1.974 | 1.923 | 1.938 | 1.936 | 1.986 |
| Fe | 0.008 | 0.013 | 0.011 | 0.019 | 0.025 | 0.002 | 0.031 | 0.006 | 0.020 | 0.009 | 0.025 | 0.020 | 0.021 | 0.004 |
| Mn | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.000 | 0.001 | 0.000 | 0.000 | 0.000 | 0.001 | 0.001 | 0.002 | 0.000 |
| Nb | 0.003 | 0.008 | 0.006 | 0.011 | 0.014 | 0.001 | 0.018 | 0.003 | 0.009 | 0.005 | 0.012 | 0.010 | 0.010 | 0.003 |
| Ta | 0.012 | 0.020 | 0.017 | 0.027 | 0.036 | 0.004 | 0.045 | 0.010 | 0.029 | 0.012 | 0.039 | 0.031 | 0.032 | 0.006 |
| | | | | | | | | | | | | | | |
| Total | 2.001 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 2.000 | 2.000 | 2.000 | 2.001 | 2.000 |
| | | | | | | | | | | | | | | |
| Sn end | 98.814 | 97.897 | 98.296 | 97.074 | 96.176 | 99.634 | 95.257 | 99.047 | 97.108 | 98.697 | 96.144 | 96.898 | 96.781 | 99.329 |
| FeMn end | 0.430 | 0.716 | 0.589 | 1.002 | 1.285 | 0.121 | 1.630 | 0.291 | 0.986 | 0.429 | 1.305 | 1.064 | 1.130 | 0.206 |
| NbTa end | 0.756 | 1.387 | 1.115 | 1.925 | 2.540 | 0.245 | 3.113 | 0.662 | 1.906 | 0.874 | 2.551 | 2.039 | 2.090 | 0.465 |
| | | | | | | | | | | | | | | |
| Nb+Ta | 0.015 | 0.028 | 0.022 | 0.039 | 0.051 | 0.005 | 0.062 | 0.013 | 0.038 | 0.017 | 0.051 | 0.041 | 0.042 | 0.009 |
| Fe+Mn | 0.009 | 0.014 | 0.012 | 0.020 | 0.026 | 0.002 | 0.033 | 0.006 | 0.020 | 0.009 | 0.026 | 0.021 | 0.023 | 0.004 |
| | | | | | | | | | | | | | | |
| Comments: | FA - FC | | | FD & FE | | FG & FH | | | few | | | DM & DN | | |
| | same grain | | | same grain | | same grain | | | tiny | | | same grain | | |
| | colourles | red | pinky red | | pink | | red | | inclusions | | | brown | | colourless |
| | contains many | | | pink | | colourless | | | | | | | red | |
| | tiny inclusions | | | | | | | | | | | | | |

| | Big Whopper pegmatite | | | | Big Whopper peg. | | | Big Whopper peg. | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DC97-7-55 | | | | DC97-8-91 | | | DC97-8-124 | | | | | | |
| | AA | AB | AC | AD | BH | BJ | BK | BA | BB | BC | BD | BE | BF | BI |
| SnO2 | 98.64 | 99.87 | 89.03 | 97.49 | 99.70 | 100.20 | 100.36 | 98.29 | 99.92 | 95.97 | 99.54 | 99.40 | 99.69 | 99.65 |
| FeO | 0.00 | 0.01 | 0.02 | 0.06 | 0.04 | 0.02 | 0.03 | 0.32 | 0.06 | 0.54 | 0.10 | 0.13 | 0.09 | 0.13 |
| MnO | 0.12 | 0.03 | 1.20 | 0.24 | 0.00 | 0.00 | 0.00 | 0.02 | 0.01 | 0.10 | 0.02 | 0.00 | 0.01 | 0.08 |
| Nb2O5 | 0.73 | 0.01 | 0.91 | 1.10 | 0.05 | 0.05 | 0.04 | 0.70 | 0.04 | 0.82 | 0.09 | 0.24 | 0.07 | 0.11 |
| Ta2O5 | 1.18 | 0.42 | 8.85 | 1.38 | 0.17 | 0.18 | 0.15 | 0.47 | 0.35 | 2.91 | 0.56 | 0.24 | 0.46 | 0.49 |
| Total | 100.67 | 100.34 | 100.01 | 100.28 | 99.96 | 100.45 | 100.59 | 99.80 | 100.38 | 100.35 | 100.32 | 100.00 | 100.32 | 100.47 |
| | **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | |
| Sn | 1.957 | 1.992 | 1.796 | 1.939 | 1.995 | 1.995 | 1.996 | 1.965 | 1.992 | 1.914 | 1.985 | 1.987 | 1.988 | 1.984 |
| Fe | 0.000 | 0.000 | 0.001 | 0.003 | 0.001 | 0.001 | 0.001 | 0.014 | 0.002 | 0.023 | 0.004 | 0.005 | 0.004 | 0.006 |
| Mn | 0.005 | 0.001 | 0.051 | 0.010 | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.004 | 0.001 | 0.000 | 0.001 | 0.003 |
| Nb | 0.016 | 0.000 | 0.021 | 0.025 | 0.001 | 0.001 | 0.001 | 0.016 | 0.001 | 0.019 | 0.002 | 0.005 | 0.002 | 0.003 |
| Ta | 0.016 | 0.006 | 0.122 | 0.019 | 0.002 | 0.002 | 0.002 | 0.006 | 0.005 | 0.040 | 0.008 | 0.003 | 0.006 | 0.007 |
| Total | 1.994 | 1.999 | 1.990 | 1.995 | 2.000 | 2.000 | 2.000 | 2.002 | 2.000 | 1.999 | 2.000 | 2.000 | 2.000 | 2.002 |
| Sn end | 98.129 | 99.626 | 90.212 | 97.181 | 99.745 | 99.783 | 99.782 | 98.172 | 99.584 | 95.742 | 99.254 | 99.305 | 99.384 | 99.095 |
| FeMn end | 0.247 | 0.076 | 2.625 | 0.631 | 0.080 | 0.040 | 0.069 | 0.721 | 0.130 | 1.350 | 0.264 | 0.264 | 0.226 | 0.446 |
| NbTa end | 1.624 | 0.298 | 7.163 | 2.188 | 0.175 | 0.177 | 0.149 | 1.107 | 0.286 | 2.908 | 0.482 | 0.431 | 0.390 | 0.458 |
| Nb+Ta | 0.032 | 0.006 | 0.143 | 0.044 | 0.004 | 0.004 | 0.003 | 0.022 | 0.006 | 0.058 | 0.010 | 0.009 | 0.008 | 0.009 |
| Fe+Mn | 0.005 | 0.002 | 0.052 | 0.013 | 0.002 | 0.001 | 0.001 | 0.014 | 0.003 | 0.027 | 0.005 | 0.005 | 0.005 | 0.009 |
| Comments: | Avalon Resources borehole | | | | | BJ & BK<br>same grain | | BA & BB<br>same grain | | | associated with<br>manganocolumbite | | | |
| | | | | | | brown | brown | black | brown | black | | | | |
| | | | | | Avalon Resources borehole | | | Avalon Resources<br>borehole | | | | | | |

**SW Petalite pegmatite**

EFR-6059

| | PC | PD | PE | PF | SA | SB | SD | PG | BA | BB | BC | BD | BE | BH | PG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 95.15 | 96.80 | 99.64 | 99.60 | 96.31 | 97.35 | 98.43 | 99.52 | 99.98 | 98.52 | 98.99 | 99.73 | 99.30 | 99.62 | 99.52 |
| FeO | 0.36 | 0.31 | 0.00 | 0.03 | 0.23 | 0.20 | 0.13 | 0.06 | 0.01 | 0.22 | 0.17 | 0.03 | 0.09 | 0.09 | 0.06 |
| MnO | 0.20 | 0.09 | 0.00 | 0.02 | 0.12 | 0.05 | 0.01 | 0.02 | 0.00 | 0.01 | 0.02 | 0.01 | 0.00 | 0.01 | 0.02 |
| Nb2O5 | 0.84 | 0.76 | 0.02 | 0.03 | 0.65 | 0.55 | 0.05 | 0.04 | 0.01 | 0.09 | 0.13 | 0.04 | 0.07 | 0.06 | 0.04 |
| Ta2O5 | 2.72 | 1.46 | 0.04 | 0.17 | 1.49 | 0.96 | 0.57 | 0.51 | 0.19 | 1.11 | 1.05 | 0.24 | 0.66 | 0.56 | 0.51 |
| Total | 99.27 | 99.42 | 99.70 | 99.85 | 98.80 | 99.11 | 99.18 | 100.14 | 100.20 | 99.95 | 100.37 | 100.04 | 100.11 | 100.35 | 100.14 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | | | | | | |
| Sn | 1.917 | 1.945 | 1.999 | 1.995 | 1.948 | 1.963 | 1.986 | 1.989 | 1.996 | 1.974 | 1.974 | 1.994 | 1.985 | 1.986 | 1.989 |
| Fe | 0.015 | 0.013 | 0.000 | 0.001 | 0.010 | 0.009 | 0.006 | 0.003 | 0.001 | 0.009 | 0.007 | 0.001 | 0.004 | 0.004 | 0.003 |
| Mn | 0.009 | 0.004 | 0.000 | 0.001 | 0.005 | 0.002 | 0.000 | 0.001 | 0.000 | 0.001 | 0.001 | 0.000 | 0.000 | 0.001 | 0.001 |
| Nb | 0.019 | 0.017 | 0.000 | 0.001 | 0.015 | 0.013 | 0.001 | 0.001 | 0.000 | 0.002 | 0.003 | 0.001 | 0.002 | 0.001 | 0.001 |
| Ta | 0.037 | 0.020 | 0.001 | 0.002 | 0.021 | 0.013 | 0.008 | 0.007 | 0.003 | 0.015 | 0.014 | 0.003 | 0.009 | 0.008 | 0.007 |
| Total | 1.998 | 1.999 | 2.000 | 2.000 | 1.999 | 1.999 | 2.001 | 2.000 | 2.000 | 2.001 | 2.000 | 2.000 | 1.999 | 2.000 | 2.000 |
| Sn end | 95.981 | 97.280 | 99.955 | 99.743 | 97.477 | 98.178 | 99.263 | 99.450 | 99.828 | 98.650 | 98.726 | 99.724 | 99.288 | 99.323 | 99.450 |
| FeMn end | 1.186 | 0.854 | 0.000 | 0.110 | 0.744 | 0.539 | 0.290 | 0.164 | 0.027 | 0.490 | 0.411 | 0.069 | 0.187 | 0.226 | 0.164 |
| NbTa end | 2.833 | 1.866 | 0.045 | 0.147 | 1.779 | 1.283 | 0.447 | 0.387 | 0.145 | 0.860 | 0.864 | 0.207 | 0.525 | 0.451 | 0.387 |
| Nb+Ta | 0.057 | 0.037 | 0.001 | 0.003 | 0.036 | 0.026 | 0.009 | 0.008 | 0.003 | 0.017 | 0.017 | 0.004 | 0.011 | 0.009 | 0.008 |
| Fe+Mn | 0.024 | 0.017 | 0.000 | 0.002 | 0.015 | 0.011 | 0.006 | 0.003 | 0.001 | 0.010 | 0.008 | 0.001 | 0.004 | 0.005 | 0.003 |
| Comments: | PC & PD<br>same grain | | | | SA & SB<br>same grain<br>Emerald Fields Resource Corporation sample | | | | | | | | | | |

**SW Beryl pegmatite**

EFR-6081

| | AA | AB | AC | AD | AE | AF | AH | AL | AM | AN |
|---|---|---|---|---|---|---|---|---|---|---|
| SnO2 | 99.30 | 98.27 | 99.54 | 96.66 | 97.99 | 97.84 | 97.98 | 97.71 | 98.81 | 95.67 |
| FeO | 0.06 | 0.29 | 0.06 | 0.70 | 0.30 | 0.30 | 0.34 | 0.51 | 0.17 | 0.79 |
| MnO | 0.00 | 0.00 | 0.00 | 0.02 | 0.00 | 0.00 | 0.04 | 0.03 | 0.01 | 0.01 |
| Nb2O5 | 0.05 | 0.47 | 0.12 | 0.98 | 0.60 | 0.49 | 0.39 | 0.46 | 0.10 | 1.48 |
| Ta2O5 | 0.30 | 0.59 | 0.20 | 1.35 | 0.73 | 0.69 | 1.07 | 2.11 | 0.51 | 1.96 |
| Total | 99.71 | 99.62 | 99.92 | 99.70 | 99.61 | 99.31 | 99.43 | 100.28 | 99.60 | 99.90 |
| **Structural formulae based on 4 oxygens** | | | | | | | | | | |
| Sn | 1.992 | 1.970 | 1.992 | 1.934 | 1.964 | 1.968 | 1.963 | 1.940 | 1.984 | 1.908 |
| Fe | 0.003 | 0.012 | 0.003 | 0.029 | 0.013 | 0.012 | 0.014 | 0.021 | 0.007 | 0.033 |
| Mn | 0.000 | 0.000 | 0.000 | 0.001 | 0.000 | 0.000 | 0.002 | 0.001 | 0.000 | 0.001 |
| Nb | 0.001 | 0.011 | 0.003 | 0.022 | 0.014 | 0.011 | 0.009 | 0.010 | 0.002 | 0.033 |
| Ta | 0.004 | 0.008 | 0.003 | 0.018 | 0.010 | 0.009 | 0.015 | 0.029 | 0.007 | 0.027 |
| Total | 2.000 | 2.001 | 2.000 | 2.005 | 2.000 | 2.001 | 2.002 | 2.001 | 2.001 | 2.002 |
| Sn end | 99.599 | 98.460 | 99.594 | 96.474 | 98.191 | 98.352 | 98.038 | 96.932 | 99.153 | 95.327 |
| FeMn end | 0.137 | 0.599 | 0.139 | 1.501 | 0.633 | 0.624 | 0.798 | 1.122 | 0.379 | 1.676 |
| NbTa end | 0.264 | 0.941 | 0.267 | 2.025 | 1.176 | 1.024 | 1.164 | 1.946 | 0.468 | 2.997 |
| Nb+Ta | 0.005 | 0.019 | 0.005 | 0.041 | 0.024 | 0.020 | 0.023 | 0.039 | 0.009 | 0.060 |
| Fe+Mn | 0.003 | 0.012 | 0.003 | 0.030 | 0.013 | 0.012 | 0.016 | 0.022 | 0.008 | 0.034 |
| Comments: | | | | | | | | AH - AN<br>same grain<br>this grain alone<br>contains small inclusions | | |

Emerald Fields Resource Corporation sample

# Metric Conversion Table

| Conversion from SI to Imperial | | | Conversion from Imperial to SI | | |
|---|---|---|---|---|---|
| *SI Unit* | *Multiplied by* | *Gives* | *Imperial Unit* | *Multiplied by* | *Gives* |
| | | | LENGTH | | |
| 1 mm | 0.039 37 | inches | 1 inch | **25.4** | mm |
| 1 cm | 0.393 70 | inches | 1 inch | **2.54** | cm |
| 1 m | 3.280 84 | feet | 1 foot | **0.304 8** | m |
| 1 m | 0.049 709 | chains | 1 chain | 20.116 8 | m |
| 1 km | 0.621 371 | miles (statute) | 1 mile (statute) | **1.609 344** | km |
| | | | AREA | | |
| 1 $\text{cm}^2$ | 0.155 0 | square inches | 1 square inch | **6.451 6** | $\text{cm}^2$ |
| 1 $\text{m}^2$ | 10.763 9 | square feet | 1 square foot | **0.092 903 04** | $\text{m}^2$ |
| 1 $\text{km}^2$ | 0.386 10 | square miles | 1 square mile | 2.589 988 | $\text{km}^2$ |
| 1 ha | 2.471 054 | acres | 1 acre | 0.404 685 6 | ha |
| | | | VOLUME | | |
| 1 $\text{cm}^3$ | 0.061 023 | cubic inches | 1 cubic inch | **16.387 064** | $\text{cm}^3$ |
| 1 $\text{m}^3$ | 35.314 7 | cubic feet | 1 cubic foot | 0.028 316 85 | $\text{m}^3$ |
| 1 $\text{m}^3$ | 1.307 951 | cubic yards | 1 cubic yard | 0.764 554 86 | $\text{m}^3$ |
| | | | CAPACITY | | |
| 1 L | 1.759 755 | pints | 1 pint | 0.568 261 | L |
| 1 L | 0.879 877 | quarts | 1 quart | 1.136 522 | L |
| 1 L | 0.219 969 | gallons | 1 gallon | **4.546 090** | L |
| | | | MASS | | |
| 1 g | 0.035 273 962 | ounces (avdp) | 1 ounce (avdp) | 28.349 523 | g |
| 1 g | 0.032 150 747 | ounces (troy) | 1 ounce (troy) | **31.103 476 8** | g |
| 1 kg | 2.204 622 6 | pounds (avdp) | 1 pound (avdp) | **0.453 592 37** | kg |
| 1 kg | 0.001 102 3 | tons (short) | 1 ton (short) | **907.184 74** | kg |
| 1 t | 1.102 311 3 | tons (short) | 1 ton (short) | **0.907 184 74** | t |
| 1 kg | 0.000 984 21 | tons (long) | 1 ton (long) | **1016.046 908 8** | kg |
| 1 t | 0.984 206 5 | tons (long) | 1 ton (long) | **1.016 046 90** | t |
| | | | CONCENTRATION | | |
| 1 g/t | 0.029 166 6 | ounce (troy)/ ton (short) | 1 ounce (troy)/ ton (short) | 34.285 714 2 | g/t |
| 1 g/t | 0.583 333 33 | pennyweights/ ton (short) | 1 pennyweight/ ton (short) | 1.714 285 7 | g/t |

OTHER USEFUL CONVERSION FACTORS

| | *Multiplied by* | |
|---|---|---|
| 1 ounce (troy) per ton (short) | 31.103 477 | grams per ton (short) |
| 1 gram per ton (short) | 0.032 151 | ounces (troy) per ton (short) |
| 1 ounce (troy) per ton (short) | 20.0 | pennyweights per ton (short) |
| 1 pennyweight per ton (short) | 0.05 | ounces (troy) per ton (short) |

*Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.*